THE NORTH KOREAN BALLISTIC MISSILE PROGRAM

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FOREWORD

North Korea's nuclear weapons and ballistic missile programs have drawn international attention for years. In the early 1960s, international and domestic political factors impelled Pyongyang to pursue an indigenous capability to produce advanced weapons systems, including rockets and missiles. However, North Korea actively sought foreign technology and assistance, particularly from China and the Soviet Union, to develop its missile capabilities. North Korea has now become a major missile exporter, creating instability in other regions of the world.

The ballistic missile inventory now totals about 800 road-mobile missiles, including about 200 *Nodong* missiles that could strike Japan. In April 2007, North Korea displayed two new missiles: a short-range tactical missile that poses a threat to Seoul and U.S. Forces in South Korea, and an intermediate-range missile that could potentially strike Guam. Although North Korea has not demonstrated the ability to produce a nuclear warhead package for its missiles, they are believed to be capable of delivering chemical and possibly biological munitions.

In this monograph, Dr. Daniel Pinkston examines North Korea's ballistic missile program in depth, its national strategy and motivations, as well as its accompanying proliferation activities. His analysis is a contribution to the Strategic Studies Institute's "Demystifying North Korea" series. We are pleased to contribute to the public discourse on this important issue.

DOUGLAS C. LOVELACE, JR.
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SUMMARY

North Korean ballistic missiles are a direct threat to Northeast Asian security, and North Korean missile proliferation poses a threat to other regions, particularly the Middle East and South Asia. North Korea is an isolated and authoritarian one-party state; the political system is based upon an extraordinary personality cult that idolizes current leader, Kim Jong Il (Kim Chŏng-il), and his deceased father, Kim Il Sung (Kim Il-sŏng). Several factors have contributed to Pyongyang's chronic insecurity including national division, the Korean War, the international politics of the Cold War, and doubts about the commitments of its alliance partners.

After failing to unify Korea by force in the early 1950s, Pyongyang tried to destabilize South Korea and trigger a revolution that would bring unification on North Korean terms. The strategy also called for a superior conventional military that could defeat South Korea before the United States could intervene. The 1960s in particular were marked by serious North Korean provocations, but Kim Il Sung was unable to "complete the revolution in the South" as stipulated under the Korean Workers' Party Bylaws.

North Korea's dissatisfaction with Chinese and Soviet support led Pyongyang to question the credibility of its alliance partners, and it began to seek an independent munitions industry in the mid-1960s. At this time, North Korea began to acquire short-range rockets, surface-to-air missiles, and coastal-defense antiship missiles from the Soviet Union and China. Institutions were also established to develop the human resources to sustain a missile development program.

In the 1970s, Pyongyang sought technology transfers and international cooperation to obtain a missile production capability. In the late 1970s and early 1980s, North Korea was developing the *Hwasŏng-5*, a reverse-engineered version of the Soviet *Scud-B* (R-17). There is disagreement over the timing and source of the *Scud-B* samples North Korea acquired, but the general consensus is that Egypt provided a few samples in the late 1970s. The first North Korean versions were flight tested in 1984 and deployed in the mid-1980s.

After the *Hwasŏng-5* began serial production in 1987, North Korean missile development accelerated at a remarkable pace. During a 5-year period (1987-92), North Korea began developing the *Hwasŏng-6* (a North Korean version of the Soviet *Scud-C*), the "*Nodong*," the *Paektusan-1* (commonly known as the *Taepodong-1*), the *Paektusan-2* (commonly known as the *Taepodong-2*), and the "*Musudan*" (a North Korean road-mobile version of the Soviet R-27/SS-N-6 "Serb" submarine-launched ballistic missile).

North Korea has successfully flight tested the *Hwasŏng-5/6* and the *Nodong*, but the single flight test of the *Paektusan-1* was only partially successful since the third stage failed, apparently exploding before it could place a small satellite into low earth orbit. The *Paektusan-2* failed after about 40-42 seconds of powered flight during its single flight test. This test, on July 5, 2006, was conducted during the country's largest ballistic missile exercise to date.

North Korea has also unveiled a new short-range solid-fuel missile called the KN-02, which is a reverse-engineered version of the Soviet SS-21 *Tochka* (*Scarab*). This missile only has a range of about 120km, but it is highly accurate and road mobile. Its solid fuel and mobility increase its survivability significantly, and it could pose a serious threat to South Korea and to U.S. Forces Korea.

North Korea has a significant infrastructure and institutional arrangement to sustain its missile program. The country is nearly self-sufficient in ballistic missile production, but still relies upon some advanced foreign technologies and components, particularly for guidance systems. Pyongyang has established foreign entities and front companies to acquire inputs, but international export controls and denial strategies have made it increasingly difficult to procure dual-use items and technologies.

North Korea has deployed about 800 road-mobile ballistic missiles, mostly in underground facilities. About 600 of these missiles are Scud variants capable of striking targets in South Korea, and some could be extended-range versions capable of striking Japanese territory. Approximately 200 road-mobile *Nodongs* could strike Tokyo. The so-called *Musudan* has not been flight tested, and it is uncertain whether it has been deployed, but the *Musudan* could potentially strike Guam.

North Korea exploded a small nuclear device on October 9, 2006, but North Korean engineers probably have not been able to miniaturize a nuclear bomb to fit on top of a missile and survive reentry. This will probably require more research, development, and testing, but foreign assistance could accelerate this timeline and cannot be ruled out. North Korean missiles are capable of delivering conventional high explosive and chemical warheads, and possibly biological weapons.

The National Defense Commission, chaired by Kim Jong Il, is the ultimate command authority for the North Korean missile arsenal; however, little is known about North Korean military doctrine. North Korean media report that the regime needs a "deterrent force" to cope with the "hostile policy" of the United States, but not much is known about operations or the

possible delegation of launch authority, and under what conditions, during wartime.

During the late 1990s, the United States and North Korea held several rounds of talks aimed at ending the North Korean ballistic missile program, but the talks were suspended with the change in U.S. administrations in 2001. The United States and North Korea are now engaged in Six-Party Talks that include China, Japan, Russia, and South Korea aimed at ending the North Korean nuclear weapons program. The talks are also committed to discussing the establishment of a regional multilateral security arrangement, which could eventually address the North Korean ballistic missile program. However, this effort will take considerable time and will have to deal with a number of complex security issues before Pyongyang will abandon its ballistic missiles.

THE NORTH KOREAN BALLISTIC MISSILE PROGRAM

INTRODUCTION

The Democratic People's Republic of Korea (DPRK or North Korea) has an extensive ballistic missile capability that poses a direct threat to Northeast Asia. Pyongyang's exports of missile systems, components, and technology also pose military threats to other regions, particularly the Middle East and South Asia. North Korea is probably the most advanced of the "late missile developers," but the program has depended upon significant foreign assistance even though Pyongyang has a long-standing economic strategy of import substitution and economic autarky under the state ideology of *chuch'e* (*juche*), or "self-reliance."

Rocket and missile development is a very difficult endeavor that requires a sustained commitment to surmount a series of complicated engineering problems. North Korea's level of missile development is remarkable given the size and backwardness of the DPRK economy; however, the program is a clear illustration of what a dedicated nation-state can achieve if given sufficient time. North Korea's perpetual insecurity has been the primary motivation to sustain its missile development program for decades, but missiles have also become an important source of foreign exchange, as well as an important symbol of power and technical prowess for the DPRK ruling elite.

This monograph first will briefly review the DPRK's national strategy and military doctrine before turning to the historical background of North Korean missile development. It also will address the issue

of foreign assistance and the institutional structure underpinning North Korea's ballistic missile program before examining questions of deployments, warheads, and command and control.

DPRK NATIONAL STRATEGY AND MOTIVATIONS

North Korea faces a number of acute internal and external security challenges that make missiles attractive to the leadership. North Korea's overarching security challenge stems from national division and the Republic of Korea (ROK or South Korea), which, along with the DPRK, claims to be the sole legitimate government for all Korean territory and people. Historical animosity from the Korean War (1950-53) is still prominent, but these negative emotions in North Korea are mostly directed towards the United States, which intervened in the war to thwart the DPRK's effort to unify Korea by force.

North Korea's ultimate strategic goal is to unify Korea on DPRK terms and maintain one-party rule under the Korean Workers' Party (KWP). According to the DPRK "Socialist Constitution" of 1998, "the DPRK shall conduct all activities under the leadership of the Korean Workers' Party."[1] The constitution also stipulates that the DPRK must be guided by the *chuch'e* idea ("juche" according to the North Korean transliteration system), which is attributed to Kim Il-sŏng, the "eternal president" of the DPRK.[2] *Chuch'e* (主體) literally means "independence" or "self-reliance," but *chuch'e* ideology is a broader and sometimes ambiguous concept that encompasses strong nationalism and the rejection of colonialism and "flunkeyism (事大主義)." *Chuch'e* originated in 1955 and became the state

doctrine underpinning Kim Il Sung's (Kim Il-sŏng's) purges of his political rivals and the establishment of the Kim family personality cult.[3] The ideology is also evident in North Korea's military doctrine, which reflects Kim Il-sŏng's thinking about national objectives and how military force should be employed to achieve those objectives.

Kim Il-sŏng was influenced by structural issues such as Korea's place in the international system and Korean national division, and by the historical lessons of his guerrilla struggle against Japanese colonialism, the Korean War, and other military conflicts. Kim was sensitive to Korea's military weakness that led to Korea's colonization by Japan in the early 20th century, and to the power of American atomic weapons that brought about Japan's defeat and unconditional surrender. During the Korean War, American threats to use nuclear weapons also had a profound impact on the DPRK leadership. North Korean officials and media continue to cite Pyongyang's perceived threat of a U.S. nuclear attack as justification for North Korea's nuclear and missile programs.[4]

After Korean liberation in August 1945, the Soviet Union provided assistance in the establishment of the Korean People's Army (KPA), and KPA officers were taught basic Soviet military doctrine. Kim Il-sŏng had been exposed to Leninist perspectives on war and to Mao's thinking on "people's war," which Kim integrated with his experience as an insurgent against the Japanese colonial authorities in the 1930s and early 1940s. Kim received a green light from Stalin to invade the South in June 1950, but he was disappointed that the Soviet Union did not provide sufficient support during the Korean War to drive American forces from the peninsula. While Kim and South Korean President Rhee Syngman (Yi Sŭng-man) wanted to continue

fighting until a clear winner emerged, Beijing, Moscow, and Washington were not interested in escalating the conflict into a global war.

DPRK leaders were disappointed with "insufficient support" from the Chinese and Soviets during the Korean War, but they were shocked by Moscow's acquiescence during the October 1962 Cuban Missile Crisis. North Korean fears of abandonment immediately led Pyongyang to seek self-reliance in the realm of national defense. In particular, during the fifth plenary meeting of the KWP Central Committee in December 1962, the DPRK adopted four guidelines for strengthening the nation's military: (1) arm all the people; (2) fortify the entire country; (3) train all military personnel as cadres; and (4) modernize the military.[5] The guideline for modernizing the military must have included plans to acquire advanced missile systems. The four guidelines are now enshrined in the DPRK Constitution as a testament to the country's commitment to independent national defense capabilities.[6]

Other factors in the 1960s that influenced DPRK national security policy included the 1961 military coup d'état in South Korea and its subsequent strongly anti-communist government; Sino-Soviet tensions; the Vietnam War; and a perceived strengthening of trilateral ties between Seoul, Tokyo, and Washington that was conspicuous by the normalization of Japan-South Korea relations in 1965. While North Korea had been primarily focused on reconstruction and economic recovery in the 1950s, Pyongyang began to shift its priorities towards development of the military by the mid-1960s. At a meeting of KWP members on October 5, 1966, Kim Il-sŏng said that the nation had to develop the economy and military in tandem

to deal with the threat of imperialism.[7] Prior to 1966, the military budget accounted for about 10 percent of the state budget, but that figure increased to about 30 percent by 1967-71.[8]

After the DPRK failed to unify Korea by force in 1950, Pyongyang turned to a "peaceful unification" policy while still trying to destabilize the ROK government and foment a popular socialist revolution in the south.[9] This strategy was supplemented by the development of joint operations and a "Two-Front War" doctrine in the 1960s and 1970s.[10] Kim Il-sŏng had expected guerrilla operations in the South to be instrumental in achieving a swift victory in the summer of 1950, but perceived inadequacies led the DPRK to expand its special forces, which are now believed to number in excess of 100,000.[11]

Under the "Two-Front War" doctrine and with improved capabilities to conduct joint military operations, the DPRK was poised to intervene in the case of a popular uprising and social chaos in the South. In this scenario, North Korean special forces could be inserted into South Korea to help topple the government, wreak havoc throughout the country, and enable the establishment of "people's government" to "complete the revolution in the South." The KPA task was to defeat the ROK military quickly before the United States could intervene as it had in 1950. Ballistic missiles capable of striking targets in the region, or ultimately in the United States, were viewed as a weapon to deter foreign forces from intervening in another Korean conflict.

The best opportunities for North Korea to have fulfilled this scenario were in the spring of 1960 and the spring of 1980. In April 1960, widespread student protests and public dissatisfaction with Rhee

Syngman's corrupt government led to the collapse of the First Republic and Rhee's exile in Hawaii. Peaceful unification on DPRK terms was not out of the question at the time given the North's superior economic performance while the ROK was one of the poorest countries in the world. DPRK leaders must have thought history was on their side, but in May 1961, a group of disgruntled military officers led by Major General Park Chung Hee (Pak Chŏng-hŭi) ousted the Second Republic and established a military government, with anti-communism as the top state objective.

Park was assassinated by Kim Chae-kyu, Director of the (South) Korean Central Intelligence Agency, in October 1979, and by the spring of 1980 demonstrations for greater political and economic reforms had become widespread. In May 1980, citizens in the City of Kwangju rebelled against local authorities, and ROK military forces were dispatched to put down the rebellion. Major General Chun Du Hwan (Chŏn Tuhwan) used the uprising as a pretext to oust President Choi Kyu Ha (Ch'oe Kyu-ha), who had succeeded Park in October 1979 but was a life-long bureaucrat with no political power base. Chun's "slow-motion" coup d'état had begun in December 1979 when Chun and his colleagues, including Major General Roh Tae Woo (No T'ae-wu), purged their rival officers in what is known as the "12.12 incident."[12]

It is uncertain whether the North Korean leadership had no intentions of intervening in the South in late 1979 or in 1980, or whether they were deterred from doing so because of the U.S.-ROK security alliance and extended deterrence. If Kim Il-sŏng had intentions to intervene during this period but was deterred, he certainly would have found long-range ballistic missiles to be attractive because they offer the potential of deterring the United States from intervening and

preventing Pyongyang from capitalizing on social unrest and political instability in the South. This "lost opportunity" also marks the period when North Korea began to allocate significant resources towards missile development.

Although South Korea failed to achieve democratization in 1980, the Fifth Republic under President Chun witnessed high economic growth rates and expanding exports. The government repressed dissident groups, but they remained active, and large-scale demonstrations in June 1987 forced the government to accept demands for democratic reforms, in particular, the direct election of the president.[13] The Chun government had to acquiesce to these demands because of the broad public support for reform. Although many of the dissidents who initially led the opposition to Chun believed in Marxism and *chuch'e* ideology, the vast majority of those opposed to the military government also loathed the North Korean regime.

The violent demonstrations in the summer of 1987 projected an image of social chaos and political instability in South Korea, but there was no public support to "complete the revolution in the South." Furthermore, the U.S.-ROK security alliance remained strong, and deterrence against any North Korean provocation was robust. South Koreans were proud to be part of a democratization wave that was also sweeping the Philippines and Taiwan, and the nation's international image was also enhanced by Seoul's hosting of the 1988 Summer Olympics. Meanwhile, the tide of history had clearly gone against the DPRK as economic stagnation was setting in and the socialist experiment in Eastern Europe and the Soviet Union was coming to an end.

North Korea's economic difficulties became apparent to the outside world in the early 1990s, but they were evident inside North Korea by the late 1980s. When the economy had already become stagnant, the terms of trade shock and termination of Soviet subsidies following the revolutions in Eastern Europe and the Union of Soviet Socialist Republics (USSR) triggered a sharp economic decline that Pyongyang is still trying to reverse. Internal insecurity was also exacerbated by the death of Kim Il-sŏng in July 1994 and by floods in 1995-96 that turned chronically poor harvests into disasters, forcing the DPRK government to appeal for international aid as the country was stricken by a nation-wide famine.

While the attraction of "completing the revolution" has now vanished in the South, Pyongyang in recent years has become preoccupied with internal security as the leadership has had to implement "emergency management" to address economic malaise, leadership succession, and potential challenges to the Kim family dynasty. The DPRK commitment to national unification and completing the revolution in the South remains on the books, but the tactics formulated in the 1960s and 1970s for achieving this objective are no longer practical. For example, according to the KWP Bylaws, the party is committed to "achieving a complete socialist victory in the northern half of the republic and to completing a people's revolution to liberate all Korean people throughout the nation."[14] The constitution declares that the DPRK shall strive to "unify the country on the principle of independence, peaceful reunification, and great national unity."[15]

True believers in Pyongyang probably think the recent negative trends will be reversed and that DPRK will regain opportunities to achieve its

national objectives in the future. Until then, the DPRK leadership almost certainly prefers to focus on internal problems. And although the KPA would not embrace the launching of a war against the South when it would almost certainly lose, the possibility cannot be ruled out. Some scholars argue that military leaders have a selection bias or preference for military options when confronted with international security problems.[16] In that case, North Korea might have a greater propensity to unleash its military since the KPA has increased its influence in domestic affairs since the demise of Kim Il-sŏng. In September 1998, the DPRK Constitution was revised to usher in the Kim Jong Il (Kim Chŏng-il) era, and it reflected the greater role of the military in state affairs by elevating the role of the National Defense Commission (NDC)[17] which has been chaired by Kim Chŏng-il since 1993. Kim has been using his positions as NDC chairman and KWP General-Secretary[18] to exert his control over North Korea's militarized society and to address challenges to social and political stability. Many analysts were puzzled that Kim Chŏng-il did not assume the presidency following his father's death, but Kim Chŏng-il skillfully appointed his loyalists into important positions prior to assuming power officially in September 1998. While many analysts view the Kim dynasty as rigid, incapable of change, and therefore doomed,[19] Kim Chŏng-il and his close associates have implemented two new state ideologies to coincide with the institutional changes of 1998 in an effort to resolve the difficulties facing the regime.

The term *sŏn'gun chŏngch'i* (先軍政治 or "military first politics"), an ideology attributed to Kim Chŏng-il, first appeared in North Korean media in December 1997, but the DPRK now cites 1995 or even earlier as the beginning of "military first politics." The North

Korean media now commonly identify this ideology as "songun" or "songun politics" in its English publications.[20] *Sŏn'gun chŏngch'i* is invoked to reassure North Koreans that Kim Chŏng-il is dedicated to providing national security against external threats, and to reassure the military--a major component of Kim's coalition--that Kim and the KWP will take care of the military and give it a first cut at scarce economic resources. *Sŏn'gun chŏngch'i* also enables Kim to reassure hard-line skeptics that security will not be compromised as the country adopts economic reforms.

Kim Chŏng-il has relied more upon the military to maintain power and govern the DPRK as the state's capacity to provide public goods and services has declined. Kim uses an elaborate system of formal and informal networks in the military and the party to access information and check potential rivals. The opaque nature of the DPRK makes it impossible to know the degree of autonomy Kim has in policy decisions, and how much he is constrained by the KPA and its internal factions.[21] Nevertheless, the KPA is the most "organized" and influential institution in the DPRK, and the military will maintain a strong influence as the country addresses the important issues of leadership succession and economic reform.

The second ideology that has emerged under Kim Chŏng-il, *kangsŏngdaeguk* or establishing a "strong and prosperous country," more broadly captures the DPRK's current national strategy. The term *kangsŏngdaeguk* (强盛大國) first appeared in North Korean media in August 1998 in reference to Kim Chŏng-il having provided "on-the-spot guidance" in Chagang Province in February 1998.[22] In an effort to build a "strong and prosperous" country, North Korea focuses on four areas: ideology,

politics, the military, and the economy.[23] The North Korean leadership apparently believes the country is strong in terms of ideology and politics because the society has been indoctrinated for decades with the *chuch'e* ideology of Kim Il-sŏng.[24] Although the military balance has worsened for the DPRK over the last 2 decades, Pyongyang appears to be confident that its military is strong given the implementation of *sŏn'gun chŏngch'i* and the demonstration of the country's "nuclear deterrent" on October 9, 2006. [25] Long-range ballistic missiles, which could deliver conventional or weapons of mass destruction (WMD) warheads, are seen as a strong deterrent against outside intervention in any internal or inter-Korean crisis.

In the economic realm, the North Korean leadership acknowledges the country's poor performance, but DPRK media portray Kim Chŏng-il as a tech-savvy modernizer dedicated to leading the country out of backwardness. The country introduced a package of economic reforms on July 1, 2002, that were targeted more at the microeconomic level than previous economic policy adjustments. While the debate continues over the success or failure of these reforms, the regime has stressed that foreign capital and technology, as well as access to foreign markets, are necessary to achieve economic recovery and sustained growth. Although the economy appears to have stabilized recently after a decade or more of negative growth, the nation's poor economic performance and dilapidated industrial infrastructure could have long-term implications for the military and the missile program, particularly the development of long-range missiles.

In sum, the DPRK established security alliances with both China and the Soviet Union during the Cold War, but fears of abandonment led Pyongyang to seek self-

reliance in the munitions industry and the capability to produce advanced weapons systems. North Korean leaders blame U.S. intervention for the failure to unify Korea in 1950, and Pyongyang has since sought the capability to deter U.S. intervention under any scenario on the Korean peninsula. In the 1960s and 1970s, North Korea actively provoked the South in an effort to create social and political instability that could have provided an opportunity to achieve a swift military victory and unification before the United States or other outside powers could intervene.

The DPRK now has abandoned most of its activities surrounding a strategy of violent subversion to achieve unification on DPRK terms; however, the use of force by Pyongyang cannot be ruled out, and the U.S.-ROK alliance must be prepared to deter any DPRK provocations. As inter-Korean competition has turned against the DPRK, Pyongyang subtly has adopted a more pragmatic approach of survival and accommodation with the ROK and its neighbors. Unification on DPRK terms would be welcomed and remains Pyongyang's ultimate goal, but regime survival has surged to the top of the agenda given the country's severe internal problems.

Recently, Pyongyang has turned to a more sophisticated policy of persuasion or a "soft power" approach to "change the hearts and minds" of South Koreans.[26] The scholarly community holds a wide range of views on the DPRK's strategic objectives, and this has resulted in conflicting policy prescriptions for dealing with Pyongyang.[27] However, this wide range of views on North Korean motivations could be irrelevant because missiles can deter enemies, earn foreign exchange through exports, and serve as a powerful domestic symbol of scientific advancement whether the DPRK is a revisionist or a status quo state.

North Koreans apparently believe that suspicions surrounding their chemical and biological weapons programs, programs which Pyongyang claims do not exist, place them within the U.S. nuclear gun sight, and therefore the DPRK is justified in maintaining its "nuclear deterrent." For example, a spokesman for the DPRK Foreign Ministry on March 13, 2002, cited U.S. press sources to infer that the United States might use nuclear weapons against underground biological and chemical weapons facilities, and that the DPRK could be a potential nuclear target.[28] DPRK radio reported on March 2, 2003, that "President Bush had approved the use of nuclear weapons as a countermeasure for somebody's use of biological and chemical weapons. It is needless to say this is targeted at us."[29] And on October 21, 2004, the Korean Central News Agency reported:

> Bush has already declassified a secret document worked out in September 2002 that approved the use of nukes under the pretext of countering the attack of biological and chemical weapons from someone. In January 2002 he announced "a report on nuclear weapons posture" in which it clarified that the U.S. would use nuclear weapons in Korea.[30]

On October 3, 2006 the DPRK Foreign Ministry announced that the country "had manufactured up-to-date nuclear weapons," and that "the U.S. extreme threat of a nuclear ``war and sanctions and pressure compel the DPRK to conduct a nuclear test." The ministry statement also asserted that North Korea has been "exposed to U.S. nuclear threats and blackmail over more than half a century."[31] North Korea subsequently exploded a nuclear device on October 9, 2006.[32]

HISTORICAL BACKGROUND OF DPRK MISSILE DEVELOPMENT

Shortly after Kim Il-sŏng's October 5, 1966, instructions to develop the military and economy jointly, the Second Machine Industry Ministry, under the KWP secretary in charge of military industries, was established to manage the procurement and production of weapons.[33] Some sources assert that North Korea had begun the production of multiple rocket launchers in the early 1960s,[34] but by 1965 Kim Il-sŏng had probably made the political decision to establish an indigenous missile production capability after the Soviets rebuffed his request for ballistic missiles. Nevertheless, during the 1960s the Soviet Union began to provide free rockets over ground (FROGs), surface-to-air missiles (SAMs), and coastal defense antiship missiles, which exposed North Korean engineers to basic technologies for rocket propulsion, guidance, and related missile systems. And in 1965, North Korea founded the Hamhŭng Military Academy, which began to train North Korean personnel in rocket and missile development.[35] According to recent accounts from a North Korean defector, the Hamhŭng Branch of the Second Natural Science Academy (第2自然科學院) conducts missile research and development, but this has not been confirmed.[36]

By 1970, North Korea had had received surface-to-ship missiles and surface-to-air missiles from China, but Pyongyang was also seeking assistance to establish its own missile development program.[37] In September 1971, North Korea signed an agreement with China to acquire, develop, and produce ballistic missiles, but significant bilateral cooperation did not begin until about 1977 when North Korean engineers participated

in a joint development program for the DF-61, which was supposed to be a liquid-fueled ballistic missile with a range of about 600km and a 1,000kg warhead. The program was cancelled in 1978 because of Chinese domestic political reasons.[38]

Around this same time, Pyongyang was also seeking Soviet missiles and technology. The DPRK did receive Soviet-made *Scud-B* ballistic missiles, but the timing of the acquisition is unclear. One North Korean defector has asserted that the Soviet Union provided about 20 *Scud-Bs* in 1972, but this claim has not been substantiated and is probably not credible.[39] Two sources in the 1980s claimed that North Korea received *Scuds* from the Soviet Union, but these reports have not been substantiated. According to the Stockholm International Peace Research Institute (SIPRI), the Soviet Union delivered about 240 *Scud-B* missiles to North Korea between 1985 and 1988, and about 100 of these were re-exported to Iran.[40] Finally, in September 1985, *Jane's Defence Weekly* quoted an anonymous source in Seoul as having said that the DPRK had been receiving *Scuds* from the USSR.[41]

The consensus in the open source literature is that the Soviet Union refused to provide *Scud*s to North Korea; and, therefore, Pyongyang was only able to receive a small number of Soviet-made *Scud-B*s and related equipment from Egypt in gratitude for the DPRK having dispatched air force pilots to assist Cairo during the 1973 Arab-Israeli War. However, there is still confusion about the timing of the Egyptian *Scud* deliveries. Some sources claim the deliveries occurred in 1976, while others report the transfer taking place sometime between 1979 and 1981.[42]

The open source literature generally asserts that North Korea was able to obtain a few Soviet-made

*Scud-B*s from Egypt and, through a reverse-engineering program, successfully developed and produced its own version dubbed the *Hwasŏng-5* (火星-5). Some sources contend that North Korean engineers accomplished this with little or no foreign support, which would be a remarkable achievement.[43] It is much more likely that Pyongyang received substantial foreign technical assistance to produce the *Hwasŏng-5*, but there are few details in the open source literature.[44]

By 1984, the DPRK had produced and flight-tested its *Hwasŏng-5*, which reportedly has a range of 320km compared to the *Scud-B*'s 300km; the extra 20km is attributed to improvements in the missile's propulsion system and not a reduction in the mass of the warhead. Just as North Korea was beginning to manufacture the *Hwasŏng-5*, Tehran approached Pyongyang in 1985 to purchase the missile for use in the "war of the cities" with Iraq.[45] North Korea had conducted only six known flight tests of the *Hwasŏng-5* in April and September 1984 with three successes and three failures, but Iran's procurement and use of the *Hwasŏng-5* provided considerable data on the system's performance in war conditions.[46] According to one source, eight *Hwasŏng-5* missiles exploded when Iranian forces attempted to launch them against Iran.[47] Iran is also said to have provided financial resources to support North Korea's *Scud* program after the two countries signed a cooperative agreement in 1985.[48]

North Korea began to construct missile bases for the *Hwasŏng-5* around 1985-86, just before the missile went into serial production around 1987. North Korea's ballistic missile development then accelerated at a fast pace; as soon as mass production of the *Hwasŏng-5* began, North Korea began developing the *Hwasŏng-6* (火星-6 or *Scud-C*), the "*Nodong*,"[49] the *Paektusan-1*

(白頭山-1; commonly known as the *Taepodong-1*), the *Paektusan-2* (白頭山-2; commonly known as the *Taepodong-2*), and the "*Musudan*"[50] all within a short period of about 5 years (1987-92). This rapid sequence of development is remarkable and historically unprecedented for a small developing country. The open source literature generally attributes this rapid development to reverse engineering and "scaling up *Scud* technology."[51] However, missile systems cannot simply be "scaled up" in a linear fashion and fly.

Missile engineers face limitations when altering design features to affect a missile's flight performance. For example, they can reduce the weight of the warhead, or extend the length of the airframe to increase the volume of fuel and oxidizer in order to extend the range. However, these changes affect the missile's mass, center of gravity, and flight dynamics, and the airframe's capacity to handle these changes is limited. When developing the *Hwasŏng-6*, North Korean missile engineers could have benefited from wreckage of Iraqi *al-Hussein* missiles provided by Iran.[52] The *al-Hussein* was a modified *Scud-B* with a range of about 600km. Iraqi engineers were able to double the range of the *Scud-B* by extending the oxidizer thank by 0.85 meters and the fuel tank by 0.45 meters, and by reducing the mass of the warhead from 1,000kg to 500kg.[53] The *Hwasŏng-6* has a range of 500km with a warhead of 770kg, and is reportedly more accurate than the *al-Hussein*.[54]

North Korea has also reportedly developed and exported other *Scud* variants with extended ranges. When the *Nodong* was being developed, some analysts erroneously called it the "*Scud*-D," probably because it was being developed almost simultaneously with the *Hwasŏng-6*.[55] Israeli intelligence has labeled a North

Korean *Scud* variant with an extended range of 700-800km the "*Scud*-D," and the missile has reportedly been exported to Syria and Libya. The *Scud*-D warhead separates from the missile airframe, which improves accuracy.[56] There are unconfirmed reports that North Korea has developed a new *Scud* variant with a range of up to 1,000km.[57] However, these reports could be references to the *Nodong*, which has been called the "*Scud*-D" in the past.

North Korea reportedly began developing the *Nodong* in 1988 or 1989.[58] Most of the open source literature asserts that the *Nodong* was designed and developed by North Korean engineers with little foreign assistance, which seems implausible given the rapid development timeline and the absence of significant flight testing, in addition to the subsequent deployment and export of the system. The first *Nodong* prototypes were produced in 1989 or 1990, and U.S. intelligence satellites photographed a *Nodong* on a mobile launcher at the Musudan-ri test site on North Korea's northeastern coast in May 1990. However, burn marks at the launch site later were detected in subsequent imagery, and analysts believe the missile exploded on the pad.[59]

Despite having failed to conduct a single successful flight test of the *Nodong*, North Korea reportedly began "small-scale" production in 1991, and in August 1992, DPRK Foreign Minister Kim Yŏng-nam traveled to Pakistan, where he is said to have discussed the *Nodong* with officials in Islamabad.[60] And in Early December 1992, a North Korean delegation traveled to Tehran to sign a bilateral military cooperation agreement that reportedly included $500 million of Iranian financial support for the "joint development of nuclear weapons and ballistic [*Nodong*] missiles."[61] Iranian officials also

observed the successful flight test of a *Nodong* from Musudan-ri during a missile exercise May 29-30, 1993; however, the missile flew only about 500km, much less than its estimated range of 1,000-1,300km.[62] The single test apparently was sufficient to convince Pakistani Prime Minster Benazir Bhutto to visit Pyongyang in late December 1993 and discuss a deal to purchase *Nodong*s and produce them in Pakistan.[63]

Although Iran and Pakistan had strong incentives to acquire ballistic missiles, it is extraordinary for countries to expend scarce financial resources for unproven weapons systems. However, extensive foreign assistance, including the possibility of licensed production, could have convinced foreign buyers that North Korean missiles are technically sound. After the collapse of the Soviet Union, several press reports indicated that Russian scientists and engineers either had been in North Korea, or were trying to travel there to provide assistance for the development of missiles or a space launch vehicle.

In February 1992, physicist Anatoliy Rubtsov began to recruit Russians to work in North Korea, and in late August 1992, 10 scientists from the Makeyev Design Bureau in Miass visited North Korea to discuss "modernizing North Korean missiles."[64] The Makeyev Design Bureau worked on the development of the *Scud* before being tasked with the development of submarine-launched ballistic missiles (SLBMs). In the fall of 1992, dozens of Russian scientists were detained in Russia as they attempted to travel to North Korea,[65] but press reports indicate that several of them, including specialists in missile warhead design, eventually were able to reach the DPRK, and that others were able to provide data and information though e-mail.[66] According to a Japanese press report in October 1993, a

total of 160 Russian scientists had been assisting North Korea develop missiles since the mid-1980s, and these Russians actively participated in the production of the *Nodong*.[67]

Despite the difficulties of missile development and the fact that other countries had tried and failed to develop medium- and intermediate-range missiles, North Korea began to produce *Nodong* prototypes around the same time it was beginning mass production of the *Hwasŏng-6* (*Scud-C*). The first *Nodong* deployments were in February 1995, even though the system only had two flight tests--one catastrophic failure and one successful flight at a reduced range.[68] By early 1997, at least 10 *Nodong*s had been deployed, and Pyongyang was exporting the system's components and technology to Iran and was preparing to ship *Nodong*s to Pakistan.[69] Iran's flight tests of the *Shehab-3*, which is based on the *Nodong*, and Pakistan's *Ghuari* flight tests have reportedly been sources of data on *Nodong* flight performance for North Korean engineers.[70]

Some press reports claim that North Korea and Libya signed a contract in October 1999 for the delivery of 50 *Nodong* systems, with the first batch shipped in July 2000.[71] However, the rumors about the *Nodong* exports to Libya proved to be false after Tripoli abandoned its WMD and missile programs in December 2003 and invited inspectors into the country to verify the dismantlement of the programs.[72] U.S. inspectors did learn in 2003 that Iraq had placed an order and paid for *Nodong* missiles, but North Korea never delivered them and then declined to refund Baghdad's $10 million down payment.[73]

U.S. intelligence assessments claim that North Korea is "nearly self-sufficient in developing and producing ballistic missiles, yet continues to procure needed

raw materials and components from various foreign sources."[74] The unclassified assessments do not specify the materials or technologies the DPRK cannot produce indigenously, but "self-sufficient development and production" would increase the nature of the threat since export controls, and efforts to deny technology transfer would be futile.

North Korea's economic development strategy has targeted heavy industry, and the country has an extensive machine tool sector. The DPRK has also acquired machine tools from abroad that could be used in missile production, so Pyongyang is probably self-sufficient in the fabrication of airframes, tanks, tubing, and other basic components. An Open Source Center analytical report concludes that North Korea is capable of producing oxidizer, rocket petroleum (RP-1), cables, integrated circuits, and special steels for missiles.[75] However, North Korea almost certainly depends upon outside sources for advanced electronics components and other sophisticated hardware for guidance systems. According to a North Korea defector (alias "Lee Bok Koo" or "Yi Bok-ku") who claims to have worked from 1988 to 1997 at a factory producing missile guidance and control systems, about 90 percent of the factory's components are imported from Japan.[76] And according to the Yonhap News Agency, in 1999 North Korea was trying to procure gyros, accelerometers, and other components for the *Nodong*'s inertial guidance system, which is estimated to give the missile a circular error probable (CEP) of 2-4km.[77]

"Lee Bok Koo," who defected in July 1997, claimed in a July 2006 interview that North Korea had spent about $900 million to procure equipment and machines from Japan as part of an import-substitution plan to establish a completely indigenous production capability.[78] However, this was later viewed to have been a mistake

since some components could be purchased abroad for less cost. Lee says that North Korea can produce everything for *Scuds* except advanced semiconductors, but he asserts that given the DPRK's level of technology, it would be difficult to produce *Nodong* missiles on its own.[79] Nevertheless, state policy emphasizes the importance of science and technology, and the DPRK has long sought technology from abroad, including technologies with military applications.[80]

Some analysts believe that foreign assistance has been so extensive that North Korea's ballistic missile program more closely resembles procurement or licensed production rather than "near self-sufficiency in development and production." For example, Robert Schmucker, an aerospace engineer and former United Nations Special Commission (UNSCOM) inspector in Iraq, has presented strong evidence to support this view. Schmucker compared the experiences of North Korea, the former Soviet Union, China, and Iraq, and he noted that the DPRK program is conspicuous with its very short development timelines and relatively few flight tests. Typically, programs have required 7-10 years to develop a new missile system, as well as 10-20 flight tests, and 3-7 flight tests to construct a firing table before deployment and use in combat.[81] And in the case of reverse engineering, which is the broad consensus regarding the *Hwasŏng-5*, Schmucker argues that engineers typically have needed 20-50 missile samples, extensive foreign support, and several flight tests; however, the consensus in the open source literature is that North Korea successfully reverse engineered the *Scud-B* in a couple of years with only a few samples and no foreign assistance. This remarkable engineering feat has led some analysts to believe that the *Hwasŏng-5/6* is more typical of licensed production, and that the *Nodong* was designed and developed by Russians.[82]

Recently, more information has surfaced to support arguments about extensive foreign assistance behind the North Korean missile program. In the early 1990s, just as North Korean engineers supposedly were completing development of the *Nodong*, four new missile ballistic systems were also being designed and developed: the *Paektusan-1* (*Taepodong-1*), the *Paektusan-2* (*Taepodong-2*), the *Musudan*, and the *KN-02*. While the *Paektusan-1* is a two- or three-stage missile with a *Nodong* first stage and *Scud*-variant as the second stage, the *Paektusan-2* and *Musudan* represent complete new systems that would require extensive design, development, and testing. The *Musudan* is the name given to a North Korean road-mobile version of the Soviet (SS-N-6) SLBM, and the *KN-02* is a North Korean version of the short-range (120km) SS-21 *Scarab* (9K79 *Tochka*).

North Korea began developing the *Paektusan-1* and *Paektusan-2* (*Taepodong-1/2*) in the late 1980s or early 1990s,[83] but since U.S. intelligence did not know the North Korean name for the missiles, analysts coined the term "*Taepodong*," which is the name of an administrative district in Musudan-ri, Hwadae-kun, North Hamgyŏng Province. Analysts previously had done the same for the *Nodong* missile, but since that name was already in use, they used the geographic name of the adjacent dong in Musudan-ri. The North Korean names of the missiles later were revealed as the *Paektusan-1* and the *Paektusan-2*.[84]

U.S. satellites detected mockups of the *Paektusan-1* and *Paektusan-2* at a research and development facility near Pyongyang in February 1994. Both systems appeared to be two-stage missiles. The *Paektusan-1*'s first stage appeared to be a *Nodong*, and the second stage was believed to be a *Scud-B*/C (*Hwasŏng-5/6*) variant. The *Paektusan-2* had a first stage that resembled the

Chinese *Dongfeng-3* (CSS-2) and a second stage with a *Nodong* variant. At that time, most U.S. intelligence analysts believed North Korea was developing the missiles indigenously, but some believed DPRK engineers were receiving assistance from China.[85] For example, in December 1991, a South Korean daily cited a "South Korean military source" as saying that North Korean had sent "90 military officials to Yinchuan, China, to learn about 'nuclear testing technology' and 'missile flight-testing technology'." The source also claimed that in December 1991, there were 230 military personnel at a Chinese naval base in Dalian to "acquire technology for ballistic missiles, ship-to-ship missiles, and surface-to-air missiles."[86] And according to *The Washington Times*, U.S. intelligence discovered 200 North Korean missile specialists traveling to China for training in 1995.[87] If North Korea did receive assistance from China during this period, it is uncertain whether the assistance was integrated into the development and flight test of the *Paektusan-1*.

In the mid 1990s, initial U.S. intelligence estimates of the *Paektusan-1* and *-2* varied considerably. In March 1994, a Pentagon spokeswoman called the program "a weapon of the future," and said it was "too early to speculate on when or if it could become operational."[88] However, in June 1994, *Jane's Defence Weekly* reported that, according to some U.S. intelligence community estimates, the *Paektusan-1* could become operational as early as 1996 and the *Paektusan-2* in 2000.[89] Contradicting those projections, in December 1996 former CIA Director Robert Gates testified before the U.S. Senate Select Committee on Intelligence that North Korea was having problems developing the *Taepodong* (*Paektusan*) missile series, and that these problems would delay deployment of the missiles.[90] John McLaughlin, vice chairman of the National

Intelligence Council, at that time said, "North Korea still had to develop a new propulsion system, develop or acquire improved guidance and control systems, and conduct a flight test program." McLaughlin also asserted, "The intelligence community is confident that the first flight test would provide at least 5 years warning before deployment."[91]

On August 7, 1998, scientific personnel began to arrive at the Musudan-ri test site to prepare for a satellite launch.[92] By mid-August, U.S. intelligence had detected activity consistent with preparation and support of a missile flight test, and on August 31, North Korea launched the *Paektusan-1* in an attempt to place a small satellite into earth orbit. U.S. intelligence observed the preparations for the launch, so the timing was not a surprise; however, most analysts did not expect the missile to be configured as a space launch vehicle with a third stage.[93] The *Paektusan-1* demonstrated successful stage separation, but the third stage failed to place the *Kwangmyŏngsŏng-1* (光明星-1) into orbit. Despite the failure, DPRK media claimed the satellite entered earth orbit after 4 minutes and 53 seconds of flight.[94]

The launch seemed to validate the July 1998 report by the Commission to Assess the Ballistic Missile Threat to the United States, or the so-called "Rumsfeld Commission" headed by Donald Rumsfeld, which warned that North Korea "was hard at work on the *Taepodong-2* ballistic missile and could deploy the missile within 5 years."[95] The Rumsfeld Commission also reported that "foreign assistance is not a wild card. It is a fact."[96] Many analysts recognized foreign assistance as a primary reason North Korea was able to launch the *Paektusan-1* in August 1998, and Russia, Ukraine, and Iran have been cited as the main actors who assisted Pyongyang.[97] China has also been cited as a source of technical assistance, but it appears to have been more

general in nature and not for the design or development of any particular ballistic missile. However, there has been wide speculation that China assisted North Korea in producing the *Kwangmyŏngsŏng-1* satellite, given its striking resemblance to China's first satellite, the *Dongfanghong-1* (東方紅-1), which was launched in 1970.

The August 31, 1998, *Paektusan-1* launch was significant for North Korean domestic politics.[98] North Korean media did not announce the test until September 4, one day before the Supreme People's Assembly amended the DPRK Constitution to usher in the Kim Chŏng-il era. The DPRK Socialist Constitution declared Kim Il-sŏng "eternal president of the DPRK" and elevated the status of the National Defense Commission, which is chaired by Kim Chŏng-il. In the days before and after the attempted satellite launch, DPRK media often made references to the doctrine of *kangsŏngdaeguk* since satellite launches and missiles represent the highest levels of technology.

The names "*Paektusan*" and "*Kwangmyŏngsŏng*" are richly symbolic for Korean nationalism and the Kim family cult. Paektusan (Mount Paektu) is the highest mountain in Korea (North and South) and is located on the border with China. According to Korean nationalist mythology, Tangun, the mythical founder of Korea, was born on the mountain in 2333 BC.[99] And according to DPRK hagiographic propaganda, the mountain is sacred as the home of Kim Il-sŏng's anti-Japanese guerrilla base, as well as the birthplace of Kim Chŏng-il. Even though Kim Chŏng-il was born in the former Soviet Far East near Khabarovsk, DPRK sources claim Kim was born on Mount Paektu, and on that day a bright lode star (kwangmyŏngsŏng) appeared in the sky, so everyone knew a new general had been born. However outlandish DPRK accounts might seem to

outsiders, North Koreans are aware that the names symbolize the revolutionary past of the father and the hope for modernization and prosperity under the son.

While DPRK media and government officials were correct that sovereign nations have the right to launch satellites and conduct ballistic missile tests, the *Paektusan-1* launch alarmed Japan and the United States, and the test help galvanize support for the development and deployment of missile defenses. The test threatened to ruin the Agreed Framework of 1994 between the United States and the DPRK, and Japan temporarily suspended financial support for Korean Peninsula Energy Development Organization (KEDO), which had been formed under the guidelines of the Agreed Framework to end Pyongyang's nuclear weapons program.[100]

The *Paektusan-1* launch spurred Washington and Pyongyang to begin serious negotiations aimed at ending the DPRK's missile ambitions. North Korea suspended bilateral missile talks with the United States in 1997, but the two sides resumed talks on October 1, 1998.[101] North Korea agreed to a unilateral moratorium on ballistic missile flight testing in September 1999 for as long as the two sides were engaged in negotiations to improve bilateral relations.[102] In January 2000, North Korea threatened to lift the moratorium because of U.S. missile defense tests in the Pacific.[103] However, in May 2001, Kim Chŏng-il told a visiting European delegation that the moratorium would remain until at least 2003.[104] When he met visiting Japanese Prime Minister Junichiro Koizumi in September 2002 and signed the so-called "Pyongyang Declaration," Kim reaffirmed that North Korea would not launch any ballistic missiles until after 2003.[105]

While North Korea upheld the flight test moratorium until July 5, 2006, Pyongyang continued

other development work for the *Paektusan-2*, the *Musudan*, the *KN-02*, and possibly an extended-range *Scud*.[106] North Korea also continued to build new underground missile bases, and continued to engage in international missile trade and technology transfers. In particular, the launch tower at Musudan-ri was modified sometime between September 1998 and November 1999 so that it could launch the *Paektusan-2*.[107] North Korean engineers worked to improve the *Paektusan-2* guidance software, and they continued to conduct static engine tests.[108]

The DPRK's unilateral flight test moratorium is usually attributed to political factors, including a thaw in inter-Korean relations, an improvement in bilateral relations between the United States and the DPRK, and a move by Pyongyang to establish or reestablish diplomatic ties with the capitalist world. The June 2000 inter-Korean summit earned South Korean President Kim Dae-jung the Nobel Peace Prize and changed the international image of the North Korean leader. Kim Chŏng-il, who had a reputation for being eccentric and reclusive, demonstrated that he is well-briefed, respectful, and a gracious host. Kim Dae-jung returned from Pyongyang proclaiming that the threat of war had been removed from the Korean peninsula.

The United States and the DPRK built upon the inter-Korean diplomatic breakthrough when they exchanged high-level envoys in October 2000. Marshal Cho Myŏng-rok, first vice chairman of the National Defense Commission, first traveled to Washington to meet with President Bill Clinton and other officials. After Cho visited the State Department in a business suit, he quickly changed into his military uniform to visit Clinton at the White House. Some analysts viewed this as being "militant" or "disrespectful" to the President, but to the domestic audience in the DPRK,

this image signaled that the KPA recognized and was willing to deal with the United States. During Marshal Cho's visit, the two sides signed a joint communiqué and a joint statement on international terrorism.[109]

The United States reciprocated by sending Secretary of State Madeleine Albright to Pyongyang to meet with Kim Chŏng-il. She described the talks as "serious, constructive, and in-depth."[110] When Kim Chŏng-il hosted Albright and her delegation for a "mass games" show at May Day Stadium, the card section displayed the launch of the *Paektusan-1*, but Kim reportedly turned to Albright immediately and said, "That was our first satellite launch, and it will be our last."[111] Washington and Pyongyang later held working-level talks to end North Korea's missile program, and President Clinton was prepared to travel to Pyongyang to sign an agreement, but time ran out at the end of his term.[112]

While political reasons are often cited for the DPRK's flight test moratorium, North Korean scientists and engineers might not have been ready to test for technical reasons. If the DPRK did not test for technical reasons, then Pyongyang could have been gaining diplomatic benefits without giving anything up in return. Furthermore, the moratorium would be an excellent cover since extended delays were uncharacteristic of the missile program's early successes, and most analysts had expected North Korea to resume testing about a year after the August 1998 *Paektusan-1* launch.[113]

The missile flight test moratorium was finally lifted on July 5, 2006, when North Korea conducted its largest live fire missile exercise. A total of seven missiles were launched throughout the day, including the *Paektusan-2* from the Musudan-ri test site. The flight tests began at 3:32 a.m. local time when a *Hwasŏng-6* was launched from a mobile launcher at Kittaeryŏng,

Anbyŏn-kun, Kangwŏn Province (see Table 1). While the two medium-range *Nodong*s and four short-range *Scud* variants performed well, the *Paektusan-2* flew for 40-42 seconds of powered flight before suffering catastrophic failure. The last missile, which was launched at 5:22 p.m., appears to have been a modified *Scud*-ER ("extended range"). This missile's range is estimated to be 600-1,000km, which is sufficient to strike southern Japan.[114]

Local Time	Missile	Launch Site	Distance/ Splashdown
3:32 a.m.	*Hwasŏng-6* (*Scud-C)*	Kittaeryŏng, Anbyŏn-kun, Kangwŏn Province	507km
4:10 a.m.	*Nodong*	Anbyŏn-kun, Kittaeryŏng	805km
4:59 a.m.	*Paektusan-2*	Musudan-ri, Hwadae-kun North Hamgyŏng Province	Exploded after 40-42 seconds of powered flight
7:12 a.m.	*Hwasŏng-6* (*Scud-C*)	Anbyŏn-kun, Kittaeryŏng	453km
7:31 a.m.	*Hwasŏng-6* (*Scud-C*)	Anbyŏn-kun, Kittaeryŏng	493km
8:17 a.m.	*Nodong*	Anbyŏn-kun, Kittaeryŏng	780km
5:22 p.m.	*Scud*-ER	Anbyŏn-kun, Kittaeryŏng	432km

Sources: *Chosun Ilbo*, Yonhap News Agency.

Table 1. DPRK Missile Launches July 5, 2006.

A number of problems could have caused the *Paektusan-2*'s failure, including failure of the propulsion or guidance systems. However, speculation has focused on the structure of the airframe. According to *Jane's Missiles and Rockets*, "aerodynamic forces, buffeting (random pressure fluctuations caused by

turbulent air flow), and/or aeroelastic effects" could have caused a structural failure since the missile malfunctioned when it "might be expected to reach transonic speeds."[115] Preparations for the *Paektusan-2* test had been observed from May 4, 2006, and there was wide spread speculation that it would be configured as a space launch vehicle to launch the *Kwangmyŏngsŏng-2* into earth orbit.[116] The DPRK leadership should be expected to exploit the domestic political benefits of a satellite launch, but the missile is believed to have been launched in its standard two-stage ballistic missile configuration.[117]

The configuration of the missile was significant for South Korean domestic politics since the Roh Moo-hyun (No Mu-hyŏn) government appeared to be downplaying the military significance of a satellite launch, while the opposition Grand National Party (GNP or "Hannaradang") criticized the Roh government for underestimating the threat and coddling Pyongyang.[118] Nevertheless, Seoul responded by revealing information about its program to develop and deploy cruise missiles that are highly accurate and militarily more significant than the *Paektusan-2*, especially for the Korean peninsula.[119]

In the United States, the media focused almost exclusively on the *Paektusan-2* launch and subsequent failure. Some commentators claimed that the launch was particularly insolent because it occurred on July 4, the American Independence Day holiday, and only minutes after the launch of the Space Shuttle Discovery from Cape Canaveral, Florida.[120] Furthermore, the launch was so offensive to China since Beijing had sent a high-level delegation to Pyongyang to request that the DPRK refrain from launching the *Paektusan-2*. Some pundits and officials seemed to mock the failure

and took the opportunity to ridicule North Korea's capabilities.[121] However, these people might have failed to recognize that Pyongyang demonstrated the operational capacity of its short-range and medium-range missile systems, and that the exercise provided valuable experience in the process of preparing and launching mobile ballistic missiles, which is not trivial. The flight tests also provided valuable data on flight performance, which is useful for DPRK missile engineers and for any DPRK firms marketing the missiles for export.[122]

The day after the missile exercise, the North Korean Foreign Ministry issued a statement asserting that the launches "were part of the routine military exercises staged by the KPA to increase the nation's military capacity for self-defense." The statement also declared that the DPRK had the sovereign right to launch missiles, and that Pyongyang was not restricted by any international law or agreements including the Missile Technology Control Regime, the missile flight test moratorium agreement with the United States of September 1999, and the DPRK-Japan Pyongyang Declaration, or the Six-Party Talks' "Statement of Principles," which was signed in September 2005 and included a DPRK commitment to end "all of its nuclear programs."[123]

The scale of the exercise and the DPRK Foreign Ministry statement the following day were anything but routine. The DPRK government bureaucracy moves slowly, and the Foreign Ministry usually takes days to respond to events; however, the swift statement clearly indicates that the DPRK wanted to suppress questions about the *Paektusan-2*'s performance, as well as preempt the international uproar that Pyongyang knew would be coming.

On July 7, Japan introduced a UN Security Council resolution drafted under Chapter VII of the UN Charter.[124] The original draft was toned down, but nevertheless, the 15-member Security Council unanimously passed Resolution 1695 on July 15. The resolution "condemned the missile launches and demanded that the DPRK suspend all activities related to its ballistic missile program, and reestablish its pre-existing commitment to a moratorium on missile launching." Furthermore, the resolution requires all UN member states "to exercise vigilance and prevent missile and missile-related items, materials, goods, and technology from being transferred to DPRK's missile or WMD programs;" and "to prevent the procurement of missiles or missile related-items, materials, goods and technology from the DPRK, and the transfer of any financial resources in relation to DPRK's missile or WMD programs."[125] The DPRK Foreign Ministry issued a statement the next day "vehemently denouncing and totally refuting the 'resolution' of the UN Security Council against the DPRK, a product of the U.S. hostile policy toward it."[126] The DPRK Ambassador to the United Nations Pak Kil-yŏn called the UN action "unjustifiable and gangster-like."[127]

Although North Korea launched seven missiles during the July 2006 exercise, the *Musudan* apparently was not flight tested. *Musudan* prototypes were reportedly spotted in 2000, and, according to a report submitted to the South Korean National Assembly by Defense Minister Cho Yŏng-gil in July 2004, deployments began in 2003 without a single flight test, which seems incredible.[128] Some have attributed North Korea's willingness to deploy missiles without flight testing to relaxed safety and operational standards; however, lenient standards cannot negate the laws of physics or necessary engineering steps. The reports

Source: Google Earth.

Map 1. Kittaeryŏng Launch Site in Anbyŏn-kun, Kangwŏn Province.

regarding deployment of the Musudan are based upon satellite imagery, which reportedly revealed ten of the missiles and mobile launchers at two new missile bases in North Korea in 2003 and early 2004.[129] And according to a November 2006 report in *Jane's Intelligence Review*, the DPRK had deployed about 15-20 *Musudan* (BM-25) missiles.[130]

There are three possible explanations for the deployments, which appear to be premature. First, the missiles identified in the satellite imagery could be nonoperational mockups or prototypes either for KPA training or for deception. Second, in December 2005, it was revealed that Iran had acquired *Musudan* missiles from the DPRK,[131] and there have been rumors that Iran has conducted a surrogate flight test.[132] Surrogate

testing for Pyongyang would be viewed as very provocative and a violation of UN Security Council Resolution 1695, so Iran and the DPRK have denied the accusations; however, bilateral missile cooperation spans 2 decades, and the two sides have incentives to continue this cooperation.[133] Or third, the system is operational, and North Korea has deployed the missile with confidence because the *Musudan* was designed, developed, and produced with extensive Russian assistance.

The *Musudan* reportedly is a road-mobile version of the Soviet R-27 (SS-N-6) SLBM. There are unconfirmed reports that North Korea has also developed a submarine-launched and/or ship-launched version.[134] The extensive foreign assistance and technical support for development of the *Musudan* could be representative of the foreign assistance that was provided for other North Korean missile systems, and this could explain the remarkably rapid development and deployment timelines in the 1980s and 1990s.

The *Musudan* development program apparently began in May 1992 when Igor Velichko, general designer of the V.P. Makeyev Engineering Design Office in Miass, Russia, went to Pyongyang to sign a $3 million contract with the Korea Yŏn'gwang Trading Company (조선연광무역회사) to "send Russian professors to teach in North Korea."[135] The contract stipulated that Russian engineers would go to the DPRK to assist in the development of a space launch vehicle called "Zyb," which is a term Makeyev uses for the R-27 (SS-N-6).[136] The Russian Ministry of General Machine Building and the Russian Security Ministry reportedly approved the contract, but between October and December 1992, dozens of Russian engineers, including ballistic missile specialists from Makeyev, were arrested by Russian

authorities as they attempted to travel to Pyongyang.[137] However, many Russian rocket specialists reportedly had already been working secretly in the DPRK, and many of the scientists who had been intercepted in late 1992 planned to go to North Korea through Europe at a later date.[138]

The *Musudan* reportedly was displayed during a military parade in Pyongyang on April 25, 2007. The event, which was held to commemorate the 75th anniversary of the founding of the KPA, was the first public display of DPRK missiles in 15 years. The DPRK television broadcast of the parade was recorded and edited, and the *Musudan* was not visible; however, U.S. satellites or unmanned aerial vehicles (UAVs) reportedly captured images of the missile at the parade.[139] DPRK authorities apparently wanted to display the missiles for the domestic audience, while concealing them from international viewers in order to prevent analysts from getting a look at the new system and to avoid international criticism. However, the television broadcast did show footage of the DPRK's new short-range tactical missile, the so-called *KN-02*, which is a North Korean reverse engineered version of the Soviet SS-21 *Tochka* ("*Scarab*").[140]

In January 1987, *The Guardian* in London reported that the Soviet Union and the DPRK had signed a secret agreement for the delivery of SS-21 missiles to North Korea, but this has not been confirmed.[141] Most analysts believe that the DPRK did not receive SS-21s from the former USSR or Russia, but instead obtained samples from Syria in the early or mid-1990s for reverse engineering.[142] Pyongyang was seeking to replace Soviet-made FROG-5s and FROG-7s artillery rockets acquired in the late 1960s and 1970s.[143]

In 1994, North Korea acquired a dual-use jet mill and related equipment from Japan.[144] Although the final end-user in the DPRK is unknown, the equipment could be used in the manufacturing of solid propellant. The *KN-02* program also received foreign assistance from Syria and probably from Iran and Pakistan.[145] In 1996, a number of Syrian missile engineers and technicians traveled to North Korea for 2 weeks. North Korean missile specialists reportedly were able to acquire information about the SS-21 and solid fuel propellant during the Syrian visit.[146] And in September 2007, the South Korea press reported that the extent of bilateral missile cooperation has been much deeper, with Syrian engineers frequently spending 6-12 months in the DPRK.[147] The third stage of the *Paektusan-1* was solid-fueled and apparently a variant of the SS-21, but North Korea was not suspected of having a solid propellant capability before the August 1998 flight test. Solid fuel makes the *KN-02* easier to store and to transport, and the missile can be launched more quickly than North Korea's liquid-fueled missiles.

The *KN-02* was first displayed on April 25, 2007 military parade in Pyongyang marking the 75th anniversary of the founding of the KPA.[148] There have been two known flight tests of the *KN-02*, a suspected failure in April 2005 and a subsequent successful test on May 1, 2005. The *KN-02* has an estimated range of 120km, which gives North Korea the capability to strike the Seoul metropolitan area and U.S. military bases in P'yŏngt'aek.[149] The CEP is estimated to be about 100-200 meters, so they are much more accurate than the *Hwasŏng-5*/6.

INSTITUTIONAL SETTING

Research and Development.

The DPRK's top-tier universities such as Kim Il Sung University and Kim Chaek University of Technology (金策工業綜合大學) train North Korea's brightest students in science and engineering.[150] Kim Il Sung University is divided into two schools: one for social sciences and one for natural sciences. The school of natural sciences has eight departments: atomic energy, automation (computer science), biology, chemistry, geography, geology, mathematics, and physics.[151] The university focuses on basic scientific research, and some of this research has applications for guidance and control of missiles, space launch vehicles, or satellites.[152]

Kim Chaek University of Technology specializes in applied technologies for industry. The university has 19 departments, including computer science, electrical engineering, electronics engineering, materials engineering, mechanical engineering, metal engineering, and nuclear engineering. The university has about 700 prominent researchers and has 11 research institutes in fields such as computers, electric circuits, materials, metals, numerically controlled devices, robotics, and semiconductors. About 1,500 students graduate from the university per year, and there are over 60,000 alumni.[153] Some of these graduates certainly have been assigned to work on DPRK missiles.

Kanggye Defense College (江界國防大學) also reportedly educates specialists in rocket technology.[154] Little is known about the programs at this college, but a former North Korean diplomat who defected to the South in 1991 claims his brother majored in rocket

technology there. Students most likely study missile maintenance and repair, as well as practical knowledge for using rockets and missiles in combat.

The State Academy of Sciences (國家科學院)[155] under the cabinet is responsible for national research and development efforts, and the academy has several research institutes that could provide or produce technology and data for missile applications. But the extent of cooperation with the military sector is unknown.[156] The Science and Technology Act as revised in May 1999 identifies six scientific fields for strategic development: aerospace engineering, biotechnology, electronics, information technology, material science, and thermal engineering. For decades, the DPRK has also sought advanced foreign technology for both civilian and military applications.[157]

The Second Natural Sciences Academy (第2自然科學院) is responsible for all applied military research. The institution was established as the National Defense Science Academy (國防科學院) in the early 1960s, but the name was changed to the Second Natural Sciences Academy in the 1970s.[158] The academy is subordinate to the KWP's Central Military Committee, and it conducts research and development for all weapons systems, making it analogous to South Korea's Agency for Defense Development (ADD). According to a North Korean assigned to the academy who defected in 1997, the academy has about 50 subordinate research institutes dedicated to weapons research and development.[159] The headquarters is located in the Yongsŏng District of Pyongyang, but the academy has research institutes in other parts of the country.

According to North Korean defector and author Yi Chŏng-yŏn, the academy's Hamhŭng Branch conducts missile research and development. The

researchers primarily are graduates from Kim Chaek University of Technology and Kanggye Defense College. According to Yi, North Koreans living nearby believe the Hamhŭng facility's two buildings belong to the Institute of National Defense Sciences (國防科學研究所) or the Institute of Chemical Materials (化學材料研究所) under the State Academy of Sciences (國家科學院).[160] Other sources report the Hamhŭng Branch as being under the State Academy of Sciences with 10 research institutes, but Yi claims the missile-related research institute is located in a different part of the city.[161] Yi asserts that in 1987 the institute developed a protective carbon material for missile airframes and warheads, and that the research staff received gifts from Kim Chŏng-il for their work.[162]

While defector Yi Chŏng-yŏn's claims could be false, it is not inconceivable that one or more of the institutes under the State Academy of Sciences' Hamhŭng Branch could be conducting weapons-related research, particularly in the field of chemical weapons. The 10 institutes under the Hamhŭng Branch are:

1. The Institute of Analytical Chemistry;
2. The Institute of Chemical Engineering;
3. The Institute of Chemical Materials;
4. The Institute of Inorganic Chemistry;
5. The Institute of Organic Chemistry;
6. The Institute of Petroleum Chemistry;
7. The Institute of Small and Medium Scale Chemical Processes;
8. The Institute of Scientific Experimental Instruments;
9. The Institute of the Preservation of Revolutionary Historic Relics; and,
10. The Institute of Vinalon.[163]

Since March 1994, there have been references in the open source literature about a missile design or research center in "Sanŭm-dong" near Pyongyang.[164] Other reports claim that "Sanŭm-dong" is near or in "Namgŭng-ri," but it most likely is a mispronunciation of "Sanŏp-dong" (産業洞), which is located in Kangsŏ-kun, South P'yŏng'an Province, about 20km west of downtown Pyongyang.[165] Sanŭm/Sanŏp-dong is probably part of the No. 125 Factory (125號 工場) or the so-called "Pyongyang Pig Factory," which is discussed below.

Weapons production in the DPRK is managed by the Second Economic Committee (第 2 經濟委員會), which ostensibly is subordinate to the KWP Central Committee Munitions Industry Department (勞動黨 中央委員會 軍需工業部); however, the National Defense Commission has the authority to provide oversight and certainly exercises direct supervision of important systems such as ballistic missiles.[166] Second Economic Committee Chairman Paek Se-bong is a standing member of the NDC.[167]

North Korea's "second economy" got its start in October 1966 when Kim Il-sŏng gave a speech at a KWP meeting and declared that national defense capabilities had to be pursued in conjunction with national economic goals to assure successful socialist revolution. In the late 1960s, the Second Machine Industry Department (第2機械工業部) was established, and then reorganized as the Second Economic Committee in the early 1970s. The committee operates about 130 munitions factories and about 60 facilities for the production of parts and components and for maintenance and repairs. The committee also controls about 100 factories that produce civilian goods but could be converted for military production.[168]

The Second Economic Committee has nine bureaus:

1. Integrated Bureau (responsible for planning, budgets, and procurement of materials);
2. First Bureau (production of small arms, ammunition, and grenades);
3. Second Bureau (production of tanks and armored vehicles);
4. Third Bureau (production of artillery and anti-aircraft artillery);
5. Fourth Bureau (production of rockets and missiles);
6. Fifth Bureau (production of chemical weapons);
7. Sixth Bureau (production of naval vessels);
8. Seventh Bureau (military communications and aeronautical related equipment); and,
9. External Economic Affairs Bureau (import and export of military-related commodities)[169]

In August 2005, the *Wŏlgan Chosŏn*, a prominent South Korean monthly, reported that a member of the DPRK's Supreme Peoples' Assembly had defected to South Korea and was being debriefed by the National Intelligence Service. The magazine used the alias "Kim Il-do" and claimed the 72-year-old was seeking asylum in another country. Kim reportedly had a doctorate and also was a researcher for the "Maritime Industries Research Institute" (海洋工業研究所) under the Second Economic Committee. Kim claims that this institute is not really involved in research but instead focuses on the development and exports of missiles.[170]

Kim Il-do testified that he traveled to Taiwan to sell missiles, which seems to diminish the credibility of the report.[171] North Korean arms sales to Taiwan would certainly bring reprisal from Beijing, which

would please staunch opponents of the DPRK regime such as the conservative *Wŏlgan Chosŏn* and most of the defector community in the ROK. North Korean defectors often exaggerate their experiences or amount of knowledge for a number of reasons, and Kim's claims have not been confirmed. The DPRK Foreign Ministry has refuted the defector report and said there is no "marine industrial institute" in the DPRK.[172]

The Second Economic Committee has operated a number of front companies over the years to procure components and inputs that could not be produced indigenously. The daughter of Kim Ch'ŏl-man, former chairman of the Second Economic Committee, is reportedly married to the son of a senior *Choch'ongnyŏn* official, which gives the committee a family connection and the opportunity to maintain close ties with *Choch'ongnyŏn* scientists and businesses in Japan. Tokyo has been cracking down on *Choch'ongnyŏn* and Japanese firms doing business with the DPRK; following the July 2006 DPRK missile exercise, Tokyo has slapped Pyongyang with very strict trade sanctions. However, in 1999, the Japanese and South Korea press reported that the Second Economic Committee had been conducting transactions with about 30 *Choch'ongnyŏn*-associated firms, and had been procuring integrated circuits for submarines and tanks, as well as spectrum analyzers for missile guidance systems though this network.[173]

There are also a number of DPRK firms, front companies, and financial institutions that are engaged in arms exports for the Second Economic Committee. Most notably, the Yong'aksan General Trading Company, and the Ch'anggwang Credit Bank have been under U.S. sanctions repeatedly for missile proliferation since March 1992,[174] but other DPRK entities have also been conduits for North Korean missile exports. Other

entities reportedly engaged in North Korea's missile trade include the Korea Chongchenggang Trading Corporation, the Changgwang Trading Company, the Puhŭng Trading Company, the Yonhap Trading Company, and the Tanch'ŏn Commercial Bank.[175]

In June 1999, the North Korean ship *Kuwŏlsan* was detained by Indian authorities and discovered to be transporting missiles, missile parts, and components, as well as machine tools for missile production. And in December 2002, the Spanish Navy, as part of a U.S.-led coalition patrolling the Arabian Sea, intercepted the North Korean ship *Sŏsan* with 15 Hwasŏng missiles destined for Yemen.[176] Coalition forces let the shipment continue because there was no legal justification for confiscating the cargo, and Yemeni President Ali Abdullah Saleh assured U.S. Vice President Dick Cheney that Yemen would cease its missile imports from the DPRK and that the missiles would only be used for national defense.[177] As the risk of interdiction increased, North Korea began to rely upon air shipments for its missile trade; the Reconnaissance Bureau of the KPA General Staff manages the missile air cargo from airfields near Pyongyang.[178]

Production.

Most of North Korea's critical munitions factories and other sensitive facilities are located underground, so much of the open source information regarding missile production plants is ambiguous, incomplete, or erroneous.[179] The DPRK's munitions industry includes several factories that are capable of producing missile components and related equipment. North Korea's economic difficulties over the last 2 decades have certainly eroded its industrial capacity, but the impact on missile component production is uncertain. While

diminished industrial capacity and severe economic distress have impaired production capacity, the DPRK has compensated for this trend by implementing and emphasizing its "military first politics."

No. 125 Factory (125號 工場), or the so-called "Pyongyang Pig Factory" in northwestern Pyongyang, reportedly produces *Hwasŏng*, *Nodong*, and surface-to-ship cruise missiles. Officials from Middle Eastern countries and possibly elsewhere have reportedly visited the factory, but the extent of their tours is unknown. Much of the open source information is based upon the testimony of Ch'oe Ju-hwal, a former KPA colonel who defected to South Korea. However, Ch'oe was not assigned to the factory, and he never served in any missile-related unit; some of the information in his statements could be from other sources or speculative.[180] The so-called Sanŏp-dong (San'ŭm-dong) facility could be the research and design component of the No. 125 Factory, or another name for the same facility.

Man'gyŏngdae Electric Machinery Factory (萬景臺弱電機械工場) is another reported missile production facility, but supposedly is in the same general area of Pyongyang as the No. 125 Factory. This plant also reportedly produces *Nodong* and surface-to-ship cruise missiles, and much of the information regarding this facility is based upon the testimony of North Korean defector Kim Kil-sŏn. Given the close proximity to the No. 125 Factory, this could be another name for the same facility. According to Kim, construction of the Man'gyŏngdae Electric Machinery Factory was completed in 1978, and this facility has been the DPRK's major missile production plant.[181]

In 2006, the South Korean press reported that two *Paektusan-2* (*Taepondong-2*) missiles were assembled at a "munitions factory" in Chamjin-ri (箴進里) in the

"area adjacent to Pyongyang and Namp'o," and that the missiles were transported to the Musudan-ri test site in early May before one was flight tested on July 5.[182] In March 1999, South Korea's daily *Kyŏnghyang Sinmun* quoted a South Korean government official as saying North Korea had a missile factory in the Kangsŏ District (江西區域) of Namp'o, but in fact, that district was part of the City of Taean which is adjacent to Namp'o.[183] Since North Korea has made several administrative changes for geographic areas over the years, many people have become confused over the place names. Furthermore, the DPRK has made considerable efforts to conceal its munitions plants and missile facilities, and underground facilities could have multiple entrances, making it appear that one facility is two or more. The DPRK has an incentive for redundancy to enhance survivability, but it is more likely that these facilities in the same general location are actually one facility with different code names.[184]

Bases and Deployment.

In the mid-1980s, the DPRK began to construct missile bases and to establish the institutional arrangement to manage its ballistic missiles. According to Chang Chun-ik, a retired ROK lieutenant general, the DPRK established its first *Hwasŏng-5* (*Scud-B*) ballistic missile unit in 1985 and deployed the unit to Hwadae-kun, North Hamgyŏng Province, which is the location of the North Korea's flight test facility.[185] According to Chang, North Korea established a new missile battalion in 1988 under the KPA IV Corps near the demilitarized zone (DMZ), and deployed a *Hwasŏng-5* regiment to the area of Sariwŏn, North Hwanghae Province, about 100km from the DMZ, at that time.[186]

The missile regiment was subsequently reorganized into a missile brigade when *Hwasŏng-6* deployments began in 1991.[187]

In contrast to Chang's view, Joseph Bermudez believes that a *Hwasŏng-5* missile regiment subordinate to the KPA Artillery Command was established around 1984-85. Bermudez asserts that the regiment probably was first deployed near Pyongyang and later moved to Chiha-ri, P'an'gyo-kun, Kangwŏn Province.[188] This divergence in analysis is indicative of the difficulty in assessing the DPRK's sensitive weapons programs and capabilities. The DPRK exerts considerable efforts to deception and concealment, including constructing missile bases underground in accordance with the Kim Il-sŏng's "Four Military Lines."[189] The KPA began constructing underground missile bases in the mid-1980s and has continued until the present.[190]

The DPRK has deployed over 600 *Hwasŏng-5/6* missiles and possibly as many as 200 *Nodong* missiles.[191] These missiles are road-mobile and liquid-fueled, and generally are stored underground and transported to sites that are little more than concrete slabs--such as Kittaeryŏng--for launch. While mobility increases survivability and the option of surprise attack, crews must erect and fuel the missiles as well as collect and input meteorological data prior to launch.[192] Nevertheless, it would be extremely difficult to execute preemptive strikes against DPRK mobile missiles. North Korea's rugged terrain, numerous underground facilities, and sheer number of missiles make it virtually impossible to destroy the DPRK missile inventory with a conventional preemptive strike.[193]

To destroy DPRK missile assets by force, it is critical to possess accurate intelligence on DPRK missile bases and support facilities. However, it is not clear if this

information is available. Some of North Korea's major bases and facilities are well-known, but information on others is sketchy. Some of the information on these facilities is based upon defector testimony that has not been substantiated. While the open source literature on DPRK missile bases is almost certainly incomplete and inaccurate to some degree, it indicates the scope of the North Korean deployments and launch capabilities (see Table 2, pages 50-51.).

In the late 1990s, North Korea established a missile division under the Ministry of the People's Armed Forces, and in late 1999, the ministry reorganized its rocket and ballistic missile units under the Missile Guidance Bureau (미사일 指導局; also known as the Missile Training Guidance Bureau, the Missile Command, or Missile Corps). North Korea's expanded missile inventory and organizational capacity have enabled the KPA to increase the scope of its missile exercises since 2001.[194]

Warheads.

North Korea's ballistic missiles are capable of delivering conventional and chemical warheads, but it is uncertain whether North Korea has nuclear or biological warheads. But given the poor accuracy of North Korea's ballistic missiles--with the exception of the *KN-02*--conventional warheads would not be very effective in destroying military targets. Instead, conventional warheads would be more effective as "terror weapons," holding large population centers in East Asia hostage, which potentially could serve Pyongyang's political purposes.

To be effective militarily, North Korea's *Hwasŏng-5*/6, *Nodong*, and *Paektusan-1*/2 would have to

be armed with WMD. There is a strong consensus that the DPRK has a large stockpile of chemical weapons (CW) and in the late 1980s, Pyongyang reportedly began producing chemical warheads for its *Hwasŏng* missiles.[195] In 2003, the CIA reported that North Korea had a "sizable but aging chemical industry" and continued to acquire dual-use chemicals that could potentially be used to support Pyongyang's long-standing CW program."[196] According to another source, the DPRK "lacks a certain number of indigenous precursors."[197] In recent years there have been several reports of the DPRK importing dual-use CW precursors, in addition to reports of similar shipments being intercepted.[198] There have been several reports over the last 3 years regarding South Korean exports of sodium cyanide, a precursor for sarin, to North Korea through China, which has led the South Korean government to tighten its export controls.[199]

Unclassified CIA estimates of the DPRK CW arsenal are vague. In 2003, the CIA said, "North Korea may possess a stockpile of unknown size," and the country had the "ability to produce bulk quantities of nerve, blister, choking, and blood agent."[200] CIA unclassified reports in previous years were similarly vague regarding the stockpile or production capacity. However, according to "intelligence reports" cited by *Jane's Intelligence Digest*, the DPRK CW infrastructure probably has about 12 facilities for the production and storage of raw chemicals, precursors, and chemical weapons.[201] On March 9, 2006, General B. B. Bell, Commander U.S. Forces Korea, testified before the House Armed Services Committee that "The size of North Korea's chemical weapons stockpile is likely significant. We assess North Korea is probably capable of weaponizing chemical agents for conventional

Location	Missiles	Status	Probable Targets
Chiha-ri, Kangwŏn Province	*Hwasŏng-5*/6; *Nodong*; *Paektusan-1* (?)	Operational	ROK; Okinawa; Guam; U.S. military forces in ROK and Japan
Mountain site near Chŏngjin, Hamgyŏng Province	*Paektusan-1* or *Paektusan-2* (?)	Completed in 1999	Guam; possibly Alaska; Hawaii; and/or western North U.S.
Chŏngju, North P'yŏng'an Province	*Hwasŏng-5*/6; *Nodong*	*Hwasŏng* and *Nodong* missile activity observed in September 2004	ROK; U.S. military forces in ROK and Japan
Chŭnggang-ŭp, Chagang Province	Possibly *Paektusan-1*; *Nodong*; and/or *Musudan*	Completed in 1995	Guam; Okinawa; U.S. military forces in Japan
Kalgol-dong, Hŭich'ŏn, Chagang Province	*Hwasŏng-5*/6	Construction began in early 1999, probably completed	ROK; U.S.military forces in ROK
Mt. Kanggamch'an, Chŭngsan-kun, South P'yŏng'an Province	*Hwasŏng-5*/6; *Nodong* (?)	Unconfirmed, but possible launch site for mobile missiles	ROK; U.S. military forces in ROK; U.S. military forces in Japan
Kilchu-kun, North Hamgyŏng Province	*Hwasŏng-5*/6	Unconfirmed, but possible launch sites for mobile missiles	ROK; U.S. military forces in ROK
Mt. Komdŏk, Hwadae-kun, North Hamgyŏng Province	*Nodong*	Probable launch sites for mobile missiles	U.S. military forces in Japan
Kŭmch'ŏn-ri, Anbyŏn-kun, Kangwŏn Province	*Hwasŏng-5*/6	Nearly completed in March 2001	ROK; U.S. military forces in ROK
Kusŏng, North P'yŏng'an Province	*Nodong*	Completed in 1995	U.S. military forces in Japan
Okp'yŏng-dong, Munch'ŏn, Kangwŏn Province	*Hwasŏng-5*/6; *Nodong* (?)	Completed in 1997 or 1998	ROK; U.S. military forces in ROK; U.S. military forces in Japan (?)
Musudan-ri, Hwadae-kun, North Hamgyŏng Province		Test site	
Sakkabbong, Koksan-kun, North Hwanghae Province	*Hwasŏng-5*/6	Nearly completed by March 2001	ROK; U.S. military forces in ROK

Table 2. North Korean Missile Bases.

Location	Missiles	Status	Probable Targets
Sangnam-ri, Hŏch'ŏn-kun, South Hamgyŏng Province	Possibly *Paektusan-1*; *Nodong*; and/or *Musudan*	60-80 percent of construction completed by March 2000	Guam; Okinawa; U.S. military forces in Japan
Sariwŏn , North Hwanghae Province	*Hwasŏng-5*/6	Completed in early 1990s (?)	ROK; U.S. military forces in ROK
Sangnam-ri, Hŏch'ŏn-kun, South Hamgyŏng Province	*Musudan*; *Paektusan-2* (?)	Large underground facility under construction; about 70-80 percent completed in 2006	U.S. military forces in Japan; Guam; possibly Alaska, Hawaii and/or western U.S.
Shin'gye-kun, North Hwanghae Province	*Hwasŏng-5*/6	Completed by 1988	ROK; U.S. military forces in ROK
Shin'o-ri, Unjŏn-kun, North P'yŏng'an Province	*Nodong*	Completed by mid-1990s	U.S. military forces in Japan
T'ŏ'gol, Pyŏngsan-kun, North Hwanghae Province	*Hwasŏng-5*/6; *Nodong* (?)	Under construction in 1999	ROK; U.S. military forces in ROK; U.S. military forces in Japan (?)
Tŏksŏng-kun, South Hamgyŏng Province		Large underground facility under construction	
Mt. Ŭngdŏk, Musudan-ri, North Hamgyŏng Province	*Nodong*	Under construction	U.S. military forces in Japan
Wŏnsan, Kangwŏn Province	*Nodong* (?); *Musudan* (?); *Paektusan-1* (?)	Under construction in July 2001	Guam; Okinawa; U.S. military forces in Japan
Yŏngjŏ-ri, Yanggang Province	*Nodong* (?); *Musudan* (?); *Paektusan-1* (?)	Completed in 2001 (?)	Guam; Okinawa; U.S. military forces in Japan
Yongnim-ŭp, Yongnim-kun, Chagang Province	*Nodong* (?); *Musudan* (?); *Paektusan-1* (?)	60-80 percent of construction completed by March 2001	Guam; Okinawa; U.S. military forces in Japan

Sources: "North Korea Country Profile," *Nuclear Threat Initiative*, *www.nti.org*; 윤덕민[Yun Dŏg-min], "북한의 탄도미사일 프로그램 평가" ["An Evaluation of North Korea's Ballistic Missile Program"], 외교암보연구원 [Institute of Foreign Affairs and National Security], July 26, 2006; 양성욱 [Yang Sŏng-uk], "북, 지하 미사일기지 건설중" ["North Now Building Underground Missile Bases"], 문화일보 [*Munhwa Ilbo*], August 3, 2006, *www.munhwa.com*.

Table 2. North Korean Missile Bases, Concluded.

weapons systems, missiles, and unconventional delivery."[202]

Recent ROK estimates place the DPRK CW stockpile at between 2,500 and 5,000 tons of various agents including sarin, tabun, mustard, phosgene, blood agent, and V-agents.[203] The South Korean open source literature expresses a consensus regarding North Korea's ability to deliver CW with its artillery, multiple rocket launchers (MRLs), FROGs, ballistic missiles, aircraft, and naval vessels.[204]

North Korea could deliver CW with ballistic missiles to rear area military bases, ports, airfields, logistics nodes, and supply networks with the intent of forestalling U.S. intervention in a second inter-Korean conflict. The number of chemical warheads and the doctrine governing their use in different contingencies are mostly speculative. However, since chemical agents dissipate, and ROK and U.S. Forces are trained to fight in a chemical environment, chemical warheads would not impair operations in ROK rear areas for very long.[205]

The information surrounding nuclear warheads is even more speculative. In the early 1990s, U.S. intelligence estimated that the DPRK probably had one or two nuclear weapons, but it was unlikely that North Korea was able to make the devices small enough for a missile. There were press reports in the early 1990s that Pyongyang had sought foreign assistance, particularly from Russia, to design a nuclear warhead, but the existence or extent of any technology transfers is unclear.[206] In 1994, U.S. Naval Intelligence warned that Pyongyang would probably be able to arm its *Nodong* missiles with nuclear warheads by 2000, and possibly by 1995.[207] Some North Korean defectors claimed during the 1990s that the DPRK possessed

nuclear warheads, but their allegations were never substantiated.

Pakistani scientist Abdul Qadeer Khan says he was taken to a facility about 1 hour out of Pyongyang and shown three nuclear devices.[208] However, the details of Khan's visit are not clear, and it is uncertain whether Khan, a metallurgist, had the expertise or the staff to examine the devices. Pakistan's Khan Research Laboratories (KRL) and North Korea have been cooperating in the field of ballistic missiles for about a decade and half, and Khan reportedly supplied Pyongyang with about 20 gas centrifuges for uranium enrichment in support of the DPRK's nascent uranium enrichment program. Khan also could have provided a bomb design for a uranium implosion device that Pakistan received from China, and that Khan subsequently provided to Libya. While North Korea's bomb program is currently based on plutonium, the blueprints and data would be useful to North Korean bomb designers.

After withdrawing from the NPT in January 2003, the DPRK Foreign Ministry announced on February 10, 2005, that North Korea possessed nuclear weapons.[209] DPRK government spokesmen and media repeatedly said Pyongyang needed a "nuclear deterrent" because of Washington's "hostile policy" and warned that it would demonstrate its deterrent if necessary. Meanwhile, U.S. intelligence was revising its estimates regarding North Korean nuclear warheads. In February 2004, Vice Admiral Lowell E. Jacoby, Director of the Defense Intelligence Agency, told the Senate Select Committee on Intelligence, "We believe North Korea has nuclear warheads from plutonium produced prior to the 1994 Agreed Framework."[210] Jacoby confirmed this view during senate testimony in April 2005.[211]

On October 3, 2006, the DPRK Foreign Ministry announced that the country would conduct a nuclear

test, which occurred on October 9, at the Mount Mant'ap nuclear test site near the village of Punggye-ri in North Hamgyŏng Province.[212] The yield of the device was about one kiloton of TNT, but North Korea reportedly informed China before the blast that the target yield was four kilotons.[213] While the exact cause of the low yield is unknown, speculation has centered on possible problems with the neutron generator, or impurities that could have contaminated the plutonium prior to detonation.[214]

According to the testimony of "Kim Il-do," the purported North Korean defector who had served in the Supreme People's Assembly and had worked for the Second Economic Committee, North Korean scientists have fabricated at least one nuclear weapon with 4kg of plutonium. The device weighs one ton and the scientists have certified to Kim Chŏng-il that it is reliable, but personally they are concerned about the dependability of the device, so they have been working to reduce the mass to 500kg.[215]

In sum, there has been widespread speculation regarding North Korea's ability to produce nuclear warheads for its ballistic missiles. Nuclear weapons and long-range delivery systems are necessary if the DPRK feels it needs a robust deterrent, but Pyongyang has failed to demonstrate the capability to miniaturize a nuclear bomb and mate it with a missile and reentry vehicle. However, if diplomacy fails to curb the North Korean nuclear program, North Korean scientists and engineers should be expected to surmount their current technical barriers since Pyongyang has demonstrated the long-term political will to sustain its missile and WMD programs.

Command and Control.

According to the DPRK Socialist Constitution of 1998, the chairman of the National Defense Commission "directs and commands all the armed forces and guides defense affairs as a whole" (Article 102). The NDC also has the authority to "proclaim a state of war and orders for mobilization" (Article 103). The command and control of the military and other national resources is different during peacetime than during national emergencies or war when all military personnel, reservists, and national resources are mobilized and placed under the "command and leadership" of the NDC chairman.

During peacetime, the Ministry of People's Armed Forces manages day-to-day KPA operations and training. During the 1980s, North Korea formalized its emergency mobilization system when it established five crisis levels.[216]

1. Level One: war;
2. Level Two: semi-war status;
3. Level Three: combat mobilization;
4. Level Four: prepare for combat mobilization; and,
5. Level Five: combat warning condition.

Under conditions of war or national emergency, the "supreme commander" (NDC chairman) takes command of all military units, KWP organizations, government entities, and national assets "to ensure victory in battle." In this case, missile units and the authority to launch are centralized under the supreme commander. Supreme Commander Kim Chŏng-il bypasses the Minister of People's Armed Forces, and issues direct orders to the General Staff.[217]

In January 2005, a South Korean daily reported that it had obtained a North Korean "war plan" that detailed mobilization procedures in time of war. The plan, if authentic, was prepared during the time that the U.S.-led coalition was conducting combat operations in Iraq and there was speculation that North Korean leaders had heightened fears of a U.S. military attack. The plan was issued under the signature of Central Military Commission (CMC) Chairman Kim Chŏng-il. The chairman's position was thought to have been vacant after the death of Kim Il-sŏng in 1994, and the CMC was thought to be relatively inactive with the prominence of the NDC. However, the plan was probably issued as a party document through KWP channels to reach civilians in case of a mobilization order. The document was defensive in tone and was not a plan for offensive strikes. There were no details for missile units other than to "strike enemy targets according to the instructions of the supreme headquarters."[218] In sum, the degree of delegation to local commanders is probably quite restricted under the DPRK's centralized command structure, which could present operational difficulties for the KPA if communications were impaired during conflict.

CONCLUSION

The DPRK faces a number of internal and external security challenges, but its chronic insecurity stems from national division and long-term enmity with the United States. Credible commitment problems in its alliance relationships pushed North Korea to seek an independent national defense posture and self-sufficient munitions industry. While vigorously pursing an import-substitution strategy in its defense sector, Pyongyang also sought technology transfers

and foreign assistance in establishing the capability to produce long-range ballistic missiles. The literature is somewhat divided over the extent of foreign assistance North Korea received, but the developmental timeline for its missile systems--particularly given the country's economic and technological assets--is quite impressive.

North Korea has also established itself as the Third World's greatest supplier of missiles, missile components, and related technologies. However, the international community has become increasingly concerned about Pyongyang's widespread proliferation activities and the insecurity it has caused. International pressure through the UN, counterproliferation efforts through the Proliferation Security Initiative (PSI), and diplomatic pressure by the United States and its allies against potential buyers have caused a decline in North Korean missile exports. This decline in exports has made it more difficult for the DPRK to establish scale economies in production and sustain the development of long-range missiles.

The technical obstacles to developing long-range ballistic missiles were apparent when the *Paektusan-2* failed catastrophically after about 40-42 seconds of powered flight during the DPRK's largest missile exercise on July 5, 2006. North Korean engineers have learned from that failure, but it could take years to correct the flaws. International export controls and domestic economic constraints could be so formidable that Pyongyang might find diplomatic initiatives to end the program an attractive alternative.

A well-crafted package of positive incentives would be even more attractive to the DPRK if the Six-Party Talks succeed in the disablement and dismantlement of North Korea's nuclear weapons program, since long-

range missiles would have little military value without nuclear warheads. If the DPRK survives as a sovereign political entity over the long term, a negotiated settlement ending the ballistic missile program will require extraordinary diplomacy linked to several other issues including the verifiable elimination of Pyongyang's WMD programs, the formal ending of the Korean War, and normalizing Pyongyang's relations with Washington and Tokyo. The Six-Party Talks have established a forum for addressing these issues, but time and sustained political willpower will be necessary for success.

Despite the political and technical obstacles facing North Korea's missile engineers, the country has already deployed over 800 ballistic missiles, and Pyongyang will continue to develop and deploy new missiles unless a negotiated settlement caps the program. The DPRK will not abandon its ballistic missiles unless it feels more secure without them. If Pyongyang refuses to abandon its ballistic missiles, the DPRK should expect to face continued international pressure, the possible interdiction of missile shipments on the high seas, an increasing ROK cruise missile capability, and an array of missile defenses in the future.

ENDNOTES

1. Article 11, Chapter One, "Politics," DPRK Socialist Constitution. As the DPRK "conducts all activities under the leadership of the KWP," social mobility is restricted to KWP members. North Korea is conspicuous among communist states with its historically large proportion of citizens holding party membership.

2. *Ibid*., Preface and Article 3.

3. For a brief introduction to *chuch'e*, see Han S. Park, "The Nature and Evolution of *Juche* Ideology," Chapter One in Han S.

Park, ed., *North Korea: Ideology, Politics Economy*, Englewood Cliffs, NJ: Prentice Hall, 1996, pp. 9-18.

4. "DPRK Is Not Fearful of Nuclear Showdown," Korean Central News Agency, January 23, 1999, *www.kcna.co.jp*; "Who Is Resorting to Nuclear Threat," Korean Central News Agency, August 20, 2000, *www.kcna.co.jp*; "Who Poses Nuclear Threat?" Korean Central News Agency, November 9, 1997, *www.kcna.co.jp*; "KCNA Dismisses Large-scale U.S. War Maneuvers as Alarming Development," Korean Central News Agency, March 21, 2003, *www.kcna.co.jp*; An Song Nam, "Process of Denuclearization on the Korean Peninsula and the Challenges," Nautilus Institute Policy Forum Online 07-049A: June 29, 2007, *www.nautilus.org/fora/security/07049Nam.html*.

5. 장명순, Chang Myŏng-sun, 북한군사연구 [*North Korean Military Research*], Seoul, South Korea: P'albog'wŏn, 1999, pp. 125-130; 곽승지, Kwak Sŭng-ji, "제2 장 안보잔략" [Chapter 2, "Security Strategy"], 세종연구소 북한연구센터 엮음 [Sejong Research Institute North Korea Research Center, ed.] 북한의 국가전략 [*North Korean National Strategy*], Seoul, South Korea: Hanŭl Academy, 2003, p. 100.

6. Article 60, Chapter Four, "National Defense," DPRK Socialist Constitution.

7. Kwak Sŭng-ji, Chapter 2, p. 103.

8. 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], Seoul, South Korea: Ministry of Unificaiton, 2003, p. 198.

9. For details on the DPRK's unification policies in the early years, see Soon Sung Cho, "The Politics of North Korea's Unification Policies 1950-1965," *World Politics*, Vol. 19, No. 2, January 1967, pp. 218-241.

10. Andrew Scobell and John M. Sanford, *North Korea's Military Threat: Pyongyang's Conventional Forces, Weapons of Mass Destruction, and Ballistic Missiles*, Carlisle Barracks, PA: U.S. Army War College, Strategic Studies Institute, April 2007, *www.strategicstudiesinstitute.army.mil/pdffiles/PUB771.pdf*, pp. 32-35.

11. B. B. Bell, "Statement of General B. B. Bell, Commander, United Nations Command; Commander, Republic of Korea-United States Combined Forces Command; and Commander, United States Forces Korea before the House Armed Services Committee," March 9, 2006; Harry P. Dies Jr., "North Korean Special Operations Forces: 1996 Kangnung Submarine Infiltration," *Military Intelligence Professional Bulletin*, Vol. 30, No. 4, October-December, 2004.

12. Carter J. Eckert *et al*., *Korea Old and New: A History*, Seoul, South Korea: Ilchokak, 1990, pp. 373-374.

13. *Ibid*., pp. 381-384.

14. "조선로동당 규약 [Korean Workers Party bylaws]," in 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], Seoul, South Korea: Ministry of Unification, 2003, pp. 504-529.

15. Article 9, Chapter One, "Politics," DPRK Constitution.

16. Scott Sagan, Chapter One, "The Origins of Military Doctrine and Command and Control Systems," in Peter R. Lavoy, Scott D. Sagan, and James J. Wirtz, eds., *Planning the Unthinkable: How New Powers will Use Nuclear, Biological and Chemical Weapons*, Ithaca, NY: Cornell University Press, 2000, pp. 16-46.

17. Paragraph Two, Chapter Six, 1998 DPRK Socialist Constitution.

18. Kim became KWP General-Secretary on October 8, 1997. 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], Seoul, South Korea: Ministry of Unification, 2003, p. 91.

19. For example, see Adrian Buzo, *The Guerilla Dynasty*, Boulder, CO: Westview Press, 1999.

20. 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], pp. 35-38; "Rodong Sinmun on Songun Politics," Korean Central News Agency, June 8, 2006, *www.kcna.co.jp*.

21. For an overview of the KPA and its role in the DPRK government, see Ken E. Gause, *North Korean Civil-Military Trends: Military First Politics to a Point*, Carlisle Barracks, PA: U.S. Army War College, Strategic Studies Institute, September 2006, *www.strategicstudiesinstitute.army.mil/pdffiles/PUB728.pdf*.

22. 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*],pp. 34-35.

23. 강성종 [Kang Sŏng-jong], 북한의 강성대국 건설전략 [*North Korea's Strategy to Build a Strong and Prosperous Country*], Seoul, South Korea: Hanŭl Academy, 2004, pp. 100-107. The ROK Ministry of Unification combines "ideology and politics" into the single dimension of ideology. See통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], Seoul, South Korea: Ministry of Unification, 2003, pp. 34-35.

24. "All People Called upon to Work Hard to Build Rich and Powerful Nation," Korean Central News Agency, November 12, 2006, *www.kcna.co.jp*; "로동신문 부강조국건설에 대한 우리 인민의 혁명적지향 [*Rodong Sinmun: Our People's Revolutionary Intention to Build a Powerful Fatherland*]," 조선중앙통신사 [KCNA], November 12, 2006, *www.kcna.co.jp*.

25. The DPRK conducted its first nuclear test on October 9, 2006. See "DPRK Successfully Conducts Underground Nuclear Test," Korean Central News Agency, October 9, 2006, *www.kcna.co.jp*; Mark Hibbs, "DPRK Test Shot Highly Inefficient, May Be Design Flaw, Experts Say," *Nucleonics Week*, Vol. 47, No. 41, October 12, 2006; Thom Shanker and David E. Sanger, "North Korean Fuel Identified As Plutonium," *The New York Times*, October 17, 2006, p. 11. On February 10, 2005, the DPRK Foreign Ministry announced that the country possesses nuclear weapons. See "DPRK FM on Its Stand to Suspend Its Participation in Six-party Talks for Indefinite Period," Korean Central News Agency, February 10, 2005, *www.kcna.co.jp*; "North Korea Vows 'Annihilating Strike' if Attacked," *Reuters*, July 3, 2006.

26. Pyongyang increasingly is using the Internet to distribute information to South Koreans and Koreans overseas. A prominent example is the website "우리민족끼리, [uriminjokkkiri]" or what

North Korea translates as "By the Korean Nation Itself." See *www.uriminzokkiri.com*.

27. For a brief overview of these diverse views, see Andrew Scobell, *North Korea's Strategic Intentions*, Carlisle Barracks, PA: U.S. Army War College, Strategic Studies Institute, July 2005, *www.strategicstudiesinstitute.army.mil/pdffiles/PUB611.pdf*.

28. The statement was in reference to the Nuclear Posture Review. However, the English version provided by the Korean Central News Agency was abbreviated and did not include the CBW references. See "미국과 한 모든 합의들을 전면검토 / 조선 외무성대변인 담화"["DPRKForeignMinistrySpokesman: All Agreements with the United States To Be Reconsidered"], 조선중앙통신사 [KCNA], March 13, 2002, *www.kcna.co.jp*.

29. Pyongyang Broadcasting Station, March 2, 2003, in "North Korea Says US Plan to Attack Nuclear Facilities 'Presupposes' Nuclear War," BBC Monitoring International Reports, March 2, 2003, in Lexis-Nexis, *www.lexis-nexis.com*.

30. "KCNA Terms U.S. Violator of AF," Korean Central News Agency, October 21, 2004, *www.kcna.co.jp*.

31. "DPRK Foreign Ministry Clarifies Stand on New Measure to Bolster War Deterrent," Korean Central News Agency, October 3, 2006, *www.kcna.co.jp*.

32. "DPRK Successfully Conducts Underground Nuclear Test," Korean Central News Agency, October 9, 2006, *www.kcna.co.jp*. See also Richard L. Garwin and Frank N. von Hippel, "A Technical Analysis: Deconstructing North Korea's October 9 Nuclear Test," *Arms Control Today*, November 2006, *www.armscontrol.org/act/2006_11/tech.asp*; Jungmin Kang and Peter Hayes, "Technical Analysis of the DPRK Nuclear Test," Nautilus Institute Policy Forum Online, October 20, 2006, *www.nautilus.org/fora/security/0689HayesKang.html*; Mark Hibbs, "DPRK Test Shot Highly Inefficient, May Be Design Flaw, Experts Say," *Nucleonics Week*, Vol. 47, No. 41, October 12, 2006, pp. 1, 10-11.

33. The Second Machine Industry Ministry was renamed the "Second Economic Committee" in 1971. The Second Economic Committee is responsible for the production of all armaments,

and will be examined in more detail. See Joseph S. Bermudez, Jr., *The Armed Forces of North Korea*, New York: I. B. Tauris, 2001, pp. 45-46.

34. Joseph S. Bermudez, Jr., "Ballistic Missile Development in the DPRK," paper presented at the Research Institute on National Security Affairs (RINSA) International Symposium, Korea National Defense University, Seoul, September 1, 1994, p. 13; Christopher F. Foss, editor, *Jane's Armour and Artillery 1991-92*, Coulsdon, Surrey, England: Jane's Information Group, 1991, p. 719.

35. Joseph S. Bermudez, Jr., "A History of Ballistic Missile Development in the DPRK," Occasional Paper No. 2, Monterey, CA: Center for Nonproliferation Studies, November 1999, p. 2; Testimony of Ko Yŏng-hwan, former DPRK Foreign Ministry official, before the United States Senate, October 21, 1997, *www.fas.org/spp/starwars/congress/1997_h/s971021ko.htm*.

36. 김민세 [Kim Min-se], "北 미사일개발 본산은 제2자연과학원 함흥분원 ["North's Missile Development Done at the Second Natural Science Academy's Hamhŭng Branch"], *The Daily NK*, February 23, 2007, *www.dailynk.com*.

37. Joseph S. Bermudez, Jr., "The North Korean '*Scud* B' Program," *Jane's Soviet Intelligence Review*, May 1989, pp. 203-207; Foss, p. 749; Gordon Jacobs and Tim McCarthy, "China's Missile Sales--Few Changes for the Future," *Jane's Intelligence Review*, December 1992, p. 560.

38. Bermudez, "A History of Ballistic Missile Development . . .," p. 3; Hua Di, "One Superpower Worse than Two," *Asia-Pacific Defense Reporter*, September 1991, pp. 14-15; John Wilson Lewis and Hua Di, "Beijing's Defense Establishment: Solving the Arms Export Enigma," *International Security*, Fall 1992, pp. 5-40.

39. The defector claims that according to documents he had seen in North Korea, Kim Il-sŏng leveraged the capture of the *USS Pueblo* and the hardware on board to procure 20 *Scud-B*s in exchange for Soviet access to the ship. Interview with North Korean defector by the author, November 1, 2000, Seoul, Korea, name withheld by request.

40. Stockholm International Peace Research Institute, *SIPRI Yearbook 1989: World Armaments and Disarmament*, Oxford, England: Oxford University Press, 1989, p. 256.

41. "'Soviet Base' in North Korea," *Jane's Defence Weekly*, September 21, 1985, p. 3.

42. Joseph S. Bermudez, Jr., "Ballistic Ambitions Ascendant," *Jane's Defence Weekly*, April 10, 1993, pp. 20, 22; Bermudez, "A History of Ballistic Missile Development . . .," p. 10; Hajime Ozu, *Missile 2000: Reference Guide to World Missile Systems*, Tokyo, Japan: Shinkigensha, 2000, p. 95; "Ballistic Missile Threat Evolves," *International Defense Review*, Vol. 33, No. 10, October 1, 2000, in Lexis-Nexis, *www.lexis-nexis.com*; Yonhap News Agency, June 24, 1993, in "Defense Ministry Says *Nodong*-1 Test in May Successful," JPRS-TND-93-020, June 28, 1993, p. 1; 통일부 [Ministry of Unification], **정보분석과** [Information Analysis Department], "북한 미사일 문제관련 참고자료" ["North Korean Missile Reference Martial"], press release, November 3, 2000, p. 1; "북한, 사정 1천킬러미터이상 미사일 개발중" ["North Korea Is Developing a Missile with a Range of Over 1,000km"], 중앙일보 [*JoongAng Ilbo*], November 8, 1991, *www.joins.com*; 장준익 [Chang Jun-ik], 북한 핵-미사일 전쟁 [*North Korea Nuclear-Missile War*], Seoul, South Korea: Sŏmundang, 1999, pp. 249, 266; 이정훈 [Yi Jŏng-hun], "프로그에서 대포동까지 북한의 미사일 게임" ["From the FROG to the Taepodong: North Korea's Missile Game"], 신동아 [*Shindonga*], August, 1999, p. 202.

43. 윤덕민 [Yun Dŏg-min], "미-북 미사일협상의 현황과 전망" ["The Current Status and Prospects for U.S.-North Missile Negotiations"], 외교안보연구원 [Institute of Foreign Affairs and National Security] policy paper, November 22, 2000, p. 1; Interview with North Korean defector Kim Kil-sŏn by Daniel A. Pinkston, April 10, 2001, Seoul, South Korea. Kim was a journalist and writer for the Second Natural Science Academy before defecting to the Republic of Korea. According to Joseph Bermudez, North Korea had an agreement with Egypt for "a limited exchange of engineers, technicians, and military personnel" related to the *Scud-B* transfers. See Bermudez, "A History of Ballistic Missile Development . . .," p. 10.

44. For example, there are at least two reports asserting that North Korea obtained *Scud* missiles directly from the Soviet Union, but these claims have not been substantiated. See, "'Soviet Base' in North Korea," *Jane's Defence Weekly*, September 21, 1985, p. 3; and *SIPRI Yearbook 1989*, p. 256.

45. Bermudez, "A History of Ballistic Missile Development . . .," p. 10; 이정훈 [Yi Jŏng-hun], "프로그에서 대포동까지 북한의 미사일 게임" ["From the FROG to the Taepodong"], p. 202; David C. Isby, "Iranian Commander Acknowledges Use of North Korean '*Scud*s'," *Jane's Missiles and Rockets*, January 1, 2007; "Albright Says Kim Admitted to Missile Sales to Syria, Iran," Japan Economic Newswire, September 28, 2003, in Lexis-Nexis, *www.lexis-nexis.com*.

46. Bermudez, "A History of Ballistic Missile Development . . .," pp. 10-11.

47. Greg Gerardi and Joseph S. Bermudez, Jr., "An Analysis of North Korean Ballistic Missile Testing," *Jane's Intelligence Review*, April 1, 1995.

48. Joseph S. Bermudez, Jr., "Ballistic Missiles in the Third World--Iran's Medium-Range Missiles," *Jane's Intelligence Review*, Vol. 4, No. 4, April 1992, p. 147; "North Korea's Ballistic Missile Programme Special Report," *Jane's Intelligence Review*, Vol. 6, No. 4, April 1, 1994.

49. North Korea has not revealed its name for this missile, so U.S. intelligence assigned it the name of an administrative district (dong) in Musdudan-ri. According to a North Korean with the alias "Lee Bok Koo" who defected in 1997 and claims to have worked in a missile guidance plant, the North Korean designation for the *Nodong* is "2-38-603-(two syllable codeword)-1." He claims "2" is for the "Second Economic Committee," "38" is for the "Number 38 Munitions Factory," and "603" is for the name of the guidance package, which is produced at the Number 603 Factory. See 홍성표 [Hong Sŏng-p'yo], "북한의 군사과학 기술(後)" ["North Korea's Military Science and Technology"], no publication date, p. 157.

50. "*Musudan*" is the name assigned to the North Korean road-mobile version of the Soviet R-27/SS-N-6 "Serb" submarine-

launched ballistic missile. See Joseph S. Bermudez, Jr., "Japan Reveals Name of North Korea's R-27 IRBM," *Jane's Defence Weekly*, May 23, 2007.

51. For example, Joseph Bermudez has written that North Korean engineers "scaled up their existing Isayev 9D21 copy" of the *Scud-B*/C engine. See Joseph S. Bermudez, Jr., "The Rise and Rise of North Korea's ICBMs," *Jane's International Defence Review*, Vol. 32, No. 7, July 1, 1999.

52. "North Korea's Ballistic Missile Programme Special Report," *Jane's Intelligence Review*, Vol. 6, No. 4, April 1, 1994; "'*Scud*' Mod C," *Jane's Defence Weekly*, April 10, 1993, Vol. 19, No. 15.

53. "Al Hussein," *Encyclopedia Astronautica*, *www.astronautix.com/lvs/alhssein.htm.*

54. According to Bermudez, the *Hwasŏng-6* warhead is 770kg, but other analysts have asserted the mass is 700kg. See Joseph S. Bermudez, Jr., "Taepo-dong Launch Brings DPRK Missiles back into the Spotlight," *Jane's Intelligence Review*, Vol. 10, No. 10, October 1, 1998; Wyn Bowen, Tim McCarthy, and Holly Porteous, "Ballistic Missile Shadow Lengthens," *Jane's International Defence Review*, Vol. 2, No. 2, January 1, 1997; "'*Scud*' Mod C."

55. "'*Scud*' Mod D," *Jane's Defense Weekly*, Vol. 19, No.15, April 10, 1993; Joseph S. Bermudez, Jr., "Ballistic Ambitions Ascendant," *Jane's Defence Weekly*, Vol. 19, No. 15, April 10, 1993.

56. "Syria's New Ballistic Missile," *Foreign Report*, Surrey, England: Jane's Information Group, August 10, 2000; "Latest Arab Missile Tests," *Jane's Intelligence Review*, September 1, 2000; David C. Isby, "Syrian *Scud* Carried a Simulated Chemical Warhead," *Jane's Missiles and Rockets*, September 1, 2001; Steve Rodan and Andrew Koch, "Syria Preparing to Build Extended-Range '*Scud*'," *Jane's Defence Weekly*, June 19, 2002; David C. Isby, "Libya Can Keep Its '*Scud*' and 'FROG' Missiles," *Jane's Missiles and Rockets*, February 1, 2004.

57. "North Korea Develops New *Scud* Missiles," *Chosun Ilbo*, February 15, 2005, *english.chosun.com/w21data/html/*

news/200502/200502150015.html; "North Korea Could Have a 1,000km-range *Scud* Derivative," *Jane's Missiles and Rockets*, April 1, 2005.

58. According to the South Korean Ministry of National Defense, the *Nodong* program began in 1988, but others claim it began in 1989. See Bermudez, "A History of Ballistic Missile Development . . .," p. 20; Yonhap News Agency, June 24, 1993, in "Defense Ministry: May *Nodong*-1 Test Successful," FBIS-EAS-93-120, June 24, 1993, p. 19; "북, 장거리포 전방지역 증강배치/국방부" ["Ministry of National Defense: North Reinforces Deployments of Long-Range Artillery in Forward Area"], 서울신문 [Seoul Sinmun], June 25, 1993, in KINDS, *www.kinds.or.kr*; Yu Yong Won, *Chosun Ilbo*, March 20, 1994, p. 4, in "Reporting on Status of Missile Development," JPRS-TND-94-008, April 1, 1994, pp. 12-13; 유용원 [Yu Yong-wŏn], "북 신형지대지 대포동1-2호 사정거리 2천~3천5백km" ["North's New Surface-to-Surface Missiles Taepodong 1-2 Have a Range of 2,000-3,500km]," 조선일보 [*Chosun Ilbo*], March 20, 1994, *www.chosun.com*.

59. Bermudez, "A History of Ballistic Missile Development . . .," pp. 21-22; Bill Gertz, "Libya May Buy N. Korean Missiles," *The Washington Times*, June 4, 1991, p. 4; Yonhap News Agency, June 24, 1993, in "Defense Ministry: May *Nodong*-1 Test Successful," FBIS-EAS-93-120, Vol. 24 June 24, 1993, p. 19.

60. Joseph S. Bermudez, Jr., "Ballistic Ambitions Ascendant," *Jane's Defence Weekly*, April 10, 1993, pp. 20, 22; Bermudez, "A History of Ballistic Missile Development . . .," pp. 21-22.

61. Yonhap News Agency, July 16, 1993, in "U.S. Report on DPRK-Iran Missile Deal Cited," FBIS-EAS-93-138, July 21, 1993, p. 33; "북한이란 핵무기개발 협정체결/미 공화당 보고서" ["U.S. Republican Party Report: North Korea and Iran Conclude Agreement to Develop Nuclear Weapons"], 세계일보 [*Segye Ilbo*], July 17, 1993, in KINDS, *www.kinds.or.kr*; "북한, 이란에 미사일 대량제공/스커드 2백20기 . . . 노동1호도 [North Korea Provides Large Number of Missiles to Iran/220 *Scud*s . . . and the *Nodong*-1]," 경향신문 [*Kyunghyang Sinmun*], July 17, 1993, in KINDS, *www.kinds.or.kr*.

62. Joseph S. Bermudez, Jr., "An Analysis of North Korean Ballistic Missile Testing," *Jane's Intelligence Review*, April 1995, pp. 186-189; David E. Sanger, "Missile Is Tested by North Koreans," *The New York Times*, June 13, 1993, p. 7; "North Korea Seen Successful in Test of *Nodong*-1 Missile," *Aerospace Daily*, June 29, 1993, pp. 538-539; Yonhap News Agency, June 24, 1993, in "Defense Ministry: May *Nodong*-1 Test Successful," FBIS-EAS-93-120, June 24, 1993, p. 19; 이정훈 [Yi Jŏng-hun], "프로그에서 대포동까지 북한의 미사일 게임 ["From the FROG to the Taepodong"], 신동아 [*Shindonga*], August, 1999, p. 203.

63. Bermudez, "A History of Ballistic Missile Development . . .," p. 23; Sharon A. Squassoni, "Weapons of Mass Destruction: Trade between North Korea and Pakistan," Congressional Research Service Report for Congress, November 28, 2006; "'북미가교역 맡겠다'/부토 파키스탄 총리" ["North-U.S. to Engage in Trade/Pakistan Prime Minister Bhutto"], 동아일보 [*Donga Ilbo*], December 28, 1993, in KINDS, *www.kinds.or.kr*.

64. Evgeni Tkachenko, "Korea Tried to Employ Russians to Modernise Its Missiles," ITAR-TASS, February 10, 1993, in Lexis-Nexis, *www.lexis-nexis.com*; Daniel Sneider, "The Trail of N. Korea's Nuclear Bid," *The Christian Science Monitor*, June 17, 1994, in Lexis-Nexis, *www.lexis-nexis.com*.

65. Evgeniy Tkachenko, ITAR-TASS, February 24, 1993, in "Missile Designers Explain Attempt to Work in DPRK," FBIS-SOV-93-035, February 24, 1993, pp. 11-12; Steven Zaloga, "Russian Reports," *Armed Forces Journal International*, April 1993, p. 17; "Russians Detain Atomic Experts Headed for North Korea: Report," Agence France Presse, December 20, 1992, in Lexis-Nexis, *www.lexis-nexis.com*; "Paper: Russia Stopped Weapons Experts on Jet to North Korea," Associated Press, December 19, 1992, in Lexis-Nexis, *www.lexis-nexis.com*; KBS-1 Radio Network, Seoul, South Korea, December 21, 1992, in "Missile Technicians Held in Moscow," JPRS-TND-93-001, January 7, 1993, p. 6.

66. Evgeni Tkachenko, "Korea Tried to Employ Russians to Modernise Its Missiles," ITAR-TASS, February 10, 1993, in Lexis-Nexis, *www.lexis-nexis.com*; Daniel Sneider, "The Trail of N. Korea's Nuclear Bid," *The Christian Science Monitor*, June 17, 1994, in Lexis-Nexis, *www.lexis-nexis.com*; Yonhap News Agency, December 21, 1992, in "Scientists Barred From Leaving Moscow,"

JPRS-TND-93-002, January 15, 1993, p. 6; Yonhap News Agency, April 23, 1994, in "Russian Scientists Assisting DPRK in Nuclear Program," JPRS-TND-94-011, May 16, 1994, pp. 51-52; "러 국방연구원 60명/작년 10월 입북 시도" ["60 Russian Defense Researchers Attempted to Enter the North in October Last Year"], 국민일보 [*Kukmin Ilbo*], February 5, 1993, p. 1쪽, in KINDS, *www.kinds.or.kr*; "북한행 러 과학자/핵탄제조 전문가/러 일간지 보도" ["Russian Daily Reports that Russian Scientists and Specialists in Nuclear Warheads Headed to the North"], 한국일보 [*Hankook Ilbo*], February 9, 1993, p. 2, in KINDS, *www.kinds.or.kr*; Warren Strobel, "N. Korea Shops for Nuke Technology in Russia," *The Washington Times*, July 5, 1994, pp. A1, A8.

67. Sergey Agafonov, *Izvestiya*, January 27, 1994, pp. 1, 4, in "'Active' Russian Participation Claimed," JPRS-TND-94-005, February 25, 1994, pp. 48-49; Sergey Agafonov, ". . . And the Japanese Weekly Has Other Documents in Store," *Izvestiya*, January 29, 1994, p. 3, in "Further on Russian Involvement," FBIS-SOV-94-020, January 31, 1994, p. 17; Pavel Felgengauer, "North Korea Has No Nuclear Bomb; The Publication in *Shukan Bunshun* Is Based on a Hoax; There Will Be No Official Investigation in the General Staff," *Segodnya*, January 29, 1994, p. 1, in "General Staff on 'Hoax'," FBIS-SOV-94-020, January 31, 1994, pp. 15-16; Radio Moscow, January 29, 1994, in "Participation in DPRK Nuclear Program Denied," FBIS-SOV-94-020, January 31, 1994, p. 15.

68. North Korea reportedly deployed up to six *Nodong*s on mobile launchers in February 1995. See Paul Beaver, "Flash Points," *Jane's Defence Weekly*, Vol. 23, No. 25, June 24, 1995, p. 22.

69. Paul Beaver, "Ten *Nodong*s Fielded but Accuracy Is Low, Says USA," *Jane's Defence Weekly*, Vol. 27, No. 21, May 28, 1997; Bermudez, "A History of Ballistic Missile Development . . .," p. 25; "Pakistan's Missile 'Was a *Nodong*'," *Jane's Missiles and Rockets*, Vol. 2, No. 5, May 1, 1998; Paul Beaver, "Pakistan Faked Ghuari Missile Pictures," *Jane's Missiles and Rockets*, Vol. 2, No. 6, June 1, 1998.

70. Duncan Lennox, "ICBM Threat to the West," *Jane's Defence Weekly*, Vol. 30, No. 5, August 5, 1998.

71. Con Coughlin, "Missile Deal Puts Israel in Gaddafi Sights," *Sunday Telegraph*, Issue 1948, September 24, 2000, *www.telegraph.co.uk*; "Libya Acquires No-Dong Missiles from N. Korea," *Middle East Newsline*, Vol. 2, No. 370, September 24, 2000, *www.menewsline.com*; Douglas Davis, "Report: Libyan Missiles Can Hit Israel," *Jerusalem Post*, September 25, 2000, p. 5, in Lexis-Nexis, *www.lexis-nexis.com*; "North Korea Deals" *Foreign Report*, Jane's Information Group, Issue 2546, June 3, 1999.

72. Andrew Koch, "Libya's Missile Programme Secrets Revealed," *Jane's Defence Weekly*, August 18, 2004.

73. David C. Isby, "Iraq Paid North Korea for No Dongs," *Jane's Missiles and Rockets*, December 1, 2003; "Iraq Planned 1,000km-range Missiles," *Jane's Missiles and Rockets*, November 1, 2003.

74. Director of Central Intelligence, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, July 1 through December 31, 2003," Unclassified DCI Report to Congress, November 2004, *www.fas.org/irp/threat/july_dec2003.pdf*; Deputy Director of National Intelligence, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, January 1 through December 31, 2004," Unclassified DDNI Report to Congress, May 2006, *www.fas.org/irp/threat/wmd-acq.pdf*.

75. "Analysis: Exploring DPRK's Space, Missile Program," February 20, 2007, Open Source Center Document FEA20070220092169.

76. "Testimony of Bok Koo Lee, Alias, Former North Korean Missile Scientist, before the Subcommittee on Financial Management, the Budget, and International Security Committee on Governmental Affairs, United States Senate," May 20, 2003.

77. 김귀근 [Kim Kwi-gŭn], "북 미사일 개발및 수출현황" ["Current status of North's missile development and exports"], Yonhap News Agency, February 6, 2002, *www.yonhapnews.co.kr*.

78. 한용걸 [Han Yong-gŏl], "'북 미사일 부품 모두 일본 통해 들어갔다' 미의회 '복면증언' 탈북자 이복구 인터뷰" ["All North's Missile Parts Come From Japan: Interview With North Korean Defector 'Yi Bok-Ku' Who Gave 'Veiled Testimony' before U.S. Congress"], 세계일보 [*Segye Ilbo*], July 14, 2006, *www.segye.com*.

79. *Ibid*.

80. Daniel A. Pinkston and Dave H. Kim, "DPRK Relying on Multiple Approaches to Acquire Foreign Technology," *WMD Insights*, March 2006, *www.wmdinsights.com/I3/EA3_DPRK_Relying.htm*; *Sankei Shimbun*, July 21, 2007, in "Japan: Article Views KAST's Role in Diverting Cutting-Edge Technologies to DPRK," Open Source Center, Document JPP20070721023001.

81. Robert H. Schmucker, "3rd World Missile Development--A New Assessment Based on UNSCOM Filed Experience and Data Evaluation," paper presented at the 12th Multinational Conference on Missile Defense, June 1-4, 1999, Edinburgh, Scotland.

82. *Ibid*.; Jim Mann, "N. Korean Missiles Have Russian Roots, Explosive Theory Suggests," *The Los Angeles Times*, September 6, 2000.

83. According to *Defense & Foreign Affairs Daily*, "Taepodong (Paektusan) design work probably began in 1988, concurrently with the *Nodong*." Bermudez asserts that development began in the early 1990s. See "Taepo-Dong Series Ballistic Missiles," *Defense & Foreign Affairs Daily*, Vol. 21, No. 24, February 18, 2003, in Lexis-Nexis, *www.lexis-nexis.com*; Joseph S. Bermudez, Jr., "Taepo-dong Launch Brings DPRK Missiles back into the Spotlight," Vol. 10, No. 10, October 1, 1998; Bermudez, "A History of Ballistic Missile Development . . .," p. 26.

84. In September 2001, a North Korean encyclopedia noted the *Paektusan-1* as the name of the space launch vehicle that was launched on August 31, 1998. In June 2006, a reporter for the pro-North Korean newspaper *Chosun Sinbo* cited North Korean officials and filed a report from Pyongyang calling the system being prepared for launch the "*Paektusan*-2." See 조선대백과사전 [*Korea Encyclopedia*], Vol. 28, Pyongyang: Paekkwasajŏnch'ulp'amsa,

2001, p. 165; Shim Kyu-sŏn, *Donga Ilbo*, September 7, 2001, in "DPRK's Taepo Dong Missile Named Paektusan No. 1," Open Source Center Document ID: KPP20010910000089; 심규선 [Sim Kyu-sŏn], "북한 대포동미사일 '백두산 1호' 공식 명명" [Official name of North Korea's Taepodong missile is '*Paektusan-1*'], 동아일보 [*Donga Ilbo*], September 8, 2001, in KINDS, *www.kinds.or.kr*; 문일 [Mun Il], "대포동미사일 정식명칭 '백두산1호로켓' " ["The Formal Name of the Taepodong Missile is the '*Paektusan-1* Rocket'"], 국민일보, September 7, 2001, in KINDS, *www.kinds.or.kr*; 김지영 [Kim Ji-yŏng], "[대포동]소동은 미국의 자작자연극" ["Uproar Over (Taepodong) Is a Self-Made Drama by the U.S."], 조선신보 [*Chosŏn Sinbo*], June 21, 2006, *www.korea-np.co.jp*.

85. Barbara Starr, "N. Korea Casts a Longer Shadow with TD-2," *Jane's Defence Weekly*, March 12, 1994, p. 1; R. Jeffrey Smith, "CIA Confirms North Korea's New Missiles," *The Washington Post*, March 18, 1994, p. A24; Yu Yong-won, "Reporting on Status of Missile Development," *Chosun Ilbo*, March 20, 1994, p. 4, in JPRS-TND-94-008, April 1, 1994, pp. 12-13; "CIA Confirms Missile Developments," *Jane's Defence Weekly*, March 26, 1994, Vol. 21, No. 12; 장준익 [Chang Jun-ik], 북한 핵-미사일 전쟁 [*North Korea Nuclear-Missile War*], Seoul, South Korea: Sŏmundang, 1999, pp. 293, 295; 유용원 [Yu Yong-wŏn], "북 신형지대지 대포동1-2호 사정거리 2천~3천5백km" ["North's New Surface-To-Surface Missiles *Taepodong 1-2* Have a Range of 2,000-3,500km"], 조선일보 [*Chosun Ilbo*], March 20, 1994, *www.chosun.com*.

86. If these accounts are true, the North Korean personnel could have been studying at the Dalian Institute of Chemical Physics, under the Chinese Academy of Sciences. The institute conducts basic and applied research in areas that could be beneficial for the development of rocket propellant combustion and other material applications for rockets. For information on the institute, see *www.dicp.ac.cn/englishvers/index.php*. Some of the information in the *Seoul Shinmun* report does not seem credible. For example, the report asserts that in July 1991, North Korea flight tested a ballistic missile with a range of 800km at a military base near Yichuan, China. This claim is unsubstantiated and does not seem credible; however, educational and technical exchanges between China and the DPRK have been maintained for decades. See "북한, 중국서 다탄두미사일 실험/사정 8백km중거리용" ["North Korea Tests a Ballistic Missile in China/Medium-Range Missile

with a Range of 800km"], 서울신문 [*Seoul Sinmun*], December 7, 1991, in KINDS, *www.kinds.or.kr*.

87. Bill Gertz, "China Assists North Korea in Space Launches," *The Washington Times*, February 23, 1999, p. A1.

88. Barbara Starr, "North Korea Grasps at the Stage beyond *Nodong* 1," *Jane's Defence Weekly*, Vol 21, No. 11, March 19, 1994.

89. Barbara Starr, "North Korean Missile R&D Gains New Pace," *Jane's Defence Weekly*, Vol. 21, No. 25, June 25, 1994.

90. Barbara Starr, "Taepodong Set for Delays," *Jane's Defence Weekly*, Vol. 26, No. 24, December 11, 1996.

91. *Ibid*.

92. "OSC Analysis 26 May: DPRK Media Portrayal of 1998 *Taepo Dong-1* Launch Reviewed," Open Source Center Document KPF20060526310001.

93. Robert D. Walpole, National Intelligence Officer for Strategic and Nuclear Programs, "North Korea's Taepo Dong Launch and Some Implications on the Ballistic Missile Threat to the United States," speech at the Center for Strategic and International Studies, Washington, DC, December 8, 1998.

94. "Successful Launch of First Satellite in DPRK," Korean Central News Agency, September 4, 1998, *www.kcna.co.jp*; "우리나라에서 첫 인공지구위성 성과적으로 발사/조선중앙통신사 보도" ["Successful Launch of the First Artificial Earth Satellite in our Country/KCNA Report"], 조선중앙통신사 [Korean Central News Agency], September 4, 1998, *www.kcna.co.jp*; "Foreign Ministry Spokesman on Successful Launch of Artificial Satellite," Korean Central News Agency, September 4, 1998, *www.kcna.co.jp*; "조선 외교부대변인 인공지구위성발사를 성과적으로 진행한데 언급" ["Korean Foreign Ministry Spokesman Comments on the Success and Progress of the Artificial Satellite Launch"], 조선중앙통신사 [Korean Central News Agency], September 4, 1998, *www.kcna.co.jp*; "'Kwangmyongsong No. 1' Revolves Round Earth," Korean Central News Agency, September 8, 1998, *www.kcna.co.jp*; Joseph S. Bermudez, Jr., "North Koreans Test Two-

Stage IRBM over Japan," *Jane's Defence Weekly*, Vol. 30, No. 10, September 9, 1998; Nicholas D. Kristof, "North Koreans Declare They Launched a Satellite, Not a Missile," *The New York Times*, September 5, 1998, p. A5, in Lexis-Nexis, *www.lexis-nexis.com*; Greg Seigle, "North Korea's Failed Satellite Bid Verified," *Jane's Defence Weekly*, Vol. 30, No. 12, September 23, 1998; "First *Taepodong 1* Launch Carried a Satellite," *Jane's Missiles & Rockets*, Vol. 2, No. 10, October 1, 1998.

95. "Executive Summary of the Report of the Commission to Assess the Ballistic Missile Threat to the United States," July 15, 1998, *www.fas.org/irp/threat/bm-threat.htm*.

96. *Ibid*.

97. Joseph S. Bermudez, Jr., "North Koreans Test Two-Stage IRBM over Japan," *Jane's Defence Weekly*, Vol. 30, No. 10, September 9, 1998; Joseph S. Bermudez, Jr. "*Taepo-dong* Launch Brings DPRK Missiles back into the Spotlight," *Jane's Intelligence Review*, Vol. 10, No. 10, October 1, 1998; Joseph S. Bermudez, Jr., "The Rise and Rise of North Korea's ICBMs," *Jane's International Defence Review*, Vol. 32, No. 7, July 1, 1999.

98. Daniel A. Pinkston, "North and South Korean Space Development," *Astropolitics*, Vol. 4, No. 2, Summer 2006, pp. 217-219.

99. According to Korean legend, Tangun descended upon Mount Paektu in 2333 BC to found the Korean nation. For a brief explanation of the Tangun legend, see Brue Cumings, *Korea's Place in the Sun*, New York: W. W. Norton, 1997, pp. 22-25. North Korea claims to have discovered Tangun's remains in Pyongyang in 1993, and has since built a tomb for him on the outskirts of Pyongyang. See "North, South Commemorate Accession Day of Nation's Founder," *The People's Korea*, October 12, 2002, pp. 1-2, *www1.korea-np.co.jp/pk/pdf/1921.pdf*. For some recent North Korean media references to the mountain, see "Mt. Paektu, Ancestral Mountain of Korea," Korean Central News Agency, August 1, 2007, *www.kcna.co.jp*; "Mt. Paektu, Pride of Korea," Korean Central News Agency, August 12, 2001, *www.kcna.co.jp*; "Re-building of Mt. Paektu Area Makes Headway," Korean Central News Agency, February 21, 2001, *www.kcna.co.jp*.

100. The Japanese government suspended its financial support for KEDO until October 21, 1998, after being pressured by the United States and South Korea to resume its funding for the project. See "Nuclear Aid to N. Korea to Stay Frozen," *The Japan Times*, September 10, 1998, in Lexis-Nexis, *www.lexis-nexis.com*; "US, ROK, Japan Meet over Funding to NK Reactor," *The Korea Times*, September 30, 1998, in Lexis-Nexis, *www.lexis-nexis.com*; "Japan Lifts Freeze on 1-B.-Dollar Contribution to KEDO," Jiji Press Ticker Service, October 21, 1998, in Lexis-Nexis, *www.lexis-nexis.com*. For information on the Agreed Framework and the Korean Peninsula Energy Development Organization, see *www.kedo.org*.

101. "USA and N Korea Set to Resume Missile Talks," *Jane's Defence Weekly*, Vol. 30, No. 11, September 16, 1998.

102. "DPRK Not to Launch Missile," Korean Central News Agency, September 24, 1999, *www.kcna.co.jp*; "조미회담진행기간에는 미싸일발사를 하지 않을것이다/외무성 대변인" ["Foreign Ministry Spokesman: We Won't Launch Missiles While Korea and the U.S. Are Engaged in Negotiations"], 조선중앙통신 [Korean Central News Agency], September 24, 1999, *www.kcna.co.jp*; Andrew Koch, "North Korean Shift Eases Tensions," *Jane's Defence Weekly*, Vol. 32, No. 13, September 29, 1999.

103. "DPRK FM Spokesman on U.S. Missile Interceptor Test," Korean Central News Agency, January 22, 2000, *www.kcna.co.jp*; "미싸일발사림시중지문제를 고려하지 않을수 없다/외무성대변인" ["Foreign Ministry Spokesman: We Have No Choice But to Reconsider the Temporary Suspension of Missile Launches"], 조선중앙통신 [Korean Central News Agency], January 22, 2000, *www.kcna.co.jp*.

104. Alex Wagner, "D.P.R.K. Extends Missile Pledge as U.S. Readies to Resume Talks," *Arms Control Today*, June 2001, *www.armscontrol.org/act/2001_06/korjun01.asp*.

105. "DPRK-Japan Pyongyang Declaration Published," Korean Central News Agency, September 17, 2002, *www.kcna.co.jp*; "조일평양선언" ["Korea-Japan Pyongyang Declaration"],

조선중앙통신 [Korean Central News Agency], September 17, 2002, *www.kcna.co.jp*; "Japan-DPRK Pyongyang Declaration," provisional English translation by the Ministry of Foreign Affairs of Japan, *www.mofa.go.jp/region/asia-paci/n_korea/pmv0209/pyongyang.html*.

106. Technically, the flight test moratorium ended on May 1, 2005 when the DPRK tested a *KN-02*. However, the test did not generate wide-spread international condemnation because the *KN-02* has a range of only 100-120 km.

107. David C. Isby, "North Korea Updates *Taepo Dong* Launch Pad," *Jane's Missile and Rockets*, July 1, 2001.

108. David C. Isby, "North Korea Develops *Taepo Dong 2* Guidance Software," *Jane's Missile and Rockets*, February 1, 2002; David C. Isby, "North Korea Continues to Test Engines and Export Missiles," *Jane's Missile and Rockets*, April 1, 2002; David C. Isby, "North Korea Rebuilds *Taepo Dong* Launch Site," *Jane's Missile and Rockets*, October 1, 2003.

109. U.S. Department of State, Office of the Spokesman, "U.S.-D.P.R.K. Joint Communique," October 12, 2000, *www.state.gov/www/regions/eap/001012_usdprk_jointcom.html*; U.S. Department of State; Office of the Spokesman, "Joint U.S.-DPRK Statement on International Terrorism," October 6, 2000, *secretary.state.gov/www/briefings/statements/2000/ps001006.html*.

110. Alex Wagner, "Albright Visits North Korea; Progress Made on Missile Front," *Arms Control Today*, November 2000, *www.armscontrol.org/act/2000_11/albrighttalks.asp*.

111. *Ibid*; Christopher Torchia, "U.S. Hears Assurances from Kim on Missiles," Associated Press, October 24, 2000, in Lexis-Nexis, *www.lexis-nexis.com*.

112. "U.S.-D.P.R.K. Missile Talks Make Little Progress," *Arms Control Today*, December 2000, *www.armscontrol.org/act/2000_12/briefsdec00.asp#Korea*; "Clinton Decides Not to Visit North Korea," *Arms Control Today*, January/February 2001, *www.armscontrol.org/act/2001_01-02/briefsjanfeb01.asp#North%20Korea*; Michael R. Gordon, "How Politics Sank Accord on Missiles With North

Korea," *The New York Times*, March 6, 2001, in Lexis-Nexis, *www.lexis-nexis.com*.

113. Elizabeth Becker, "U.S. Says Photos Show North Korea Preparing for Missile," *The New York Times*, June 18, 1999, in Lexis-Nexis, *www.lexis-nexis.com*; Robert Burns, "Pentagon Official Says North Korea Preparing for a Missile Launch," Associated Press, June 30, 1999, in Lexis-Nexis, *www.lexis-nexis.com*; Bill Gertz and Rowan Scarborough, "Inside the Ring," *The Washington Times*, July 16, 1999, p. A7, in Lexis-Nexis, *www.lexis-nexis.com*; Jun Kwan-Woo, "N. Korea Ready to Launch Missile with 6,700-Kilometre Range," Agence France Presse, August 11, 1999, in Lexis-Nexis, *www.lexis-nexis.com*; "North Korea Preparing to Test Long-Range Missile, Says Seoul," Deutsche Presse-Agentur, July 16, 1999, in Lexis-Nexis, *www.lexis-nexis.com*; 한승동 [Han Sŭng-dong], "북 미사일 발사대 대형화 공사" ["Construction to Increase the Size of the North's Missile Launch Tower"], 한겨레 [*Hankyroreh*], June 18, 1999, in KINDS, *www.kinds.or.kr*; "북 대포동 2호 발사기지로 옮겨" ["North Moves *Taepodong-2* to Launch Base"], 국민일보 [*Kukmin Ilbo*], July 19, 1999, in KINDS, *www.kinds.or.kr*.

114. "North Korea Develops New *Scud* Missiles," *Chosun Ilbo*, February 15, 2005, *english.chosun.com/w21data/html/news/200502/200502150015.html*; 유용원 [Yu Yong-wŏn], "북, 새 스커드 미사일 개발" ["North Develops New *Scud* Missile"], 조선일보 [*Chosun Ilbo*], February 15, 2005, at *nk.chosun.com*.

115. Doug Richardson, "Transonic Buffeting May Have Doomed *Taepo Dong-2*," *Jane's Missiles and Rockets*, August 1, 2006.

116. Peter Spiegel and Barbara Demick, "U.S. Pressures North Korea over Missile," *The Los Angeles Times*, June 20, 2006, in Lexis-Nexis, *www.lexis-nexis.com*; Moon Hae-won, "Gov't Still Uncertain Whether N. Korea Will Launch Missile," Yonhap News Agency, June 20, 2006, in Lexis-Nexis, *www.lexis-nexis.com*; "N. Korea May Test-fire Missile as Early as Sunday," Japan Economic Newswire, June 17, 2006, in Lexis-Nexis, *www.lexis-nexis.com*.

117. Richardson, "Transonic Buffeting . . ."

118. Daniel A. Pinkston, "North Korea Missile Exercise Has Political Impacts for South Korea," *WMD Insights*, September 2006, *www.wmdinsights.org/I8/I8_EA2_NKMissile.htm*.

119. Daniel A. Pinkston, "South Korean Response to North Korean July Missile Exercise Includes Unveiling of New Cruise Missile," *WMD Insights*, October 2006, *www.wmdinsights.com/I9/I9_EA2_SKResponse.htm*; Daniel A. Pinkston, "South Korea Tests 1,000 Kilometer-Range Cruise Missile and Develops 1,500 Kilometer-Range Version," *WMD Insights*, November 2006, *www.wmdinsights.com/I10/I10_EA3_SKTests1000km.htm*.

120. Bill Gertz, "North Korea Launches Missile Show; Multiple Tests Include Failure of Long-range *Taepodong-2*," *The Washington Times*, July 5, 2006, in Lexis-Nexis, *www.lexis-nexis.com*; Lee Joo-hee, "N. Korea Plays Missile Card: International Tension, Pressure on Pyongyang Mount," *The Korea Herald*, July 6, 2006, in Lexis-Nexis, *www.lexis-nexis.com*.

121. "'Countdown with Keith Olbermann' for July 5," updated July 6, 2006, *www.msnbc.msn.com/id/13735478/*; Stephen J. Hedges, "Experts See Test Launch of Missiles as Abject Failure," *The Chicago Tribune*, July 5, 2006, in Lexis-Nexis, *www.lexis-nexis.com*.

122. For details on the flight performance of the *Paektusan-2*, see C. P. Vick, "May, June, July 2006 Build-up to the *Taep'o-dong-2C/3* Satellite Launch Attempt," *GlobalSecurity.org*, *www.globalsecurity.org/wmd/library/news/dprk/2006/060710-nkir2627.htm*.

123. "DPRK Foreign Ministry Spokesman on Its Missile Launches," Korean Central News Agency, July 6, 2006, *www.kcna.co.jp*; "외무성대변인 미싸일발사는 정상 군사훈련의 일환" ["Foreign Ministry Spokesman: Missile Launches Are Part of Normal Military Training"], 조선중앙통신 [Korean Central News Agency], July 6, 2006, *www.kcna.co.jp*. The Six-Party Talks include China, the DPRK, Japan, the ROK, Russia, and the United States. The six parties signed a "Statement of Principles" on September 19, 2005, in Beijing whereby the DPRK agreed to abandon all of its nuclear programs. For the text of the statement, see "Joint Statement of the Fourth Round of the Six-Party Talks Beijing, September 19, 2005," *www.state.gov/r/pa/prs/ps/2005/53490.htm*.

124. Warren Hoge and Norimitsu Onishi, "China Fights Sanctions to Punish North Korea," *The New York Times*, July 8, 2006, in Lexis-Nexis, *www.lexis-nexis.com*.

125. Warren Hoge, "U.N. Council, in Weakened Resolution, Demands End to North Korean Missile Program," *The New York Times*, July 16, 2006, in Lexis-Nexis, *www.lexis-nexis.com*; United Nations Security Council, "Security Council Condemns Democratic People's Republic of Korea's Missile Launches, Unanimously Adopting Resolution, 2006," New York: Department of Public Information, News and Media Division, July 15, 2006, *www.un.org/News/Press/docs/2006/sc8778.doc.htm*.

126. The statement was obviously for foreign consumption. The Korean Central News Agency did not carry a Korean version of the statement. See "DPRK Foreign Ministry Refutes 'Resolution of UN Security Council'," Korean Central News Agency, July 16, 2006, *www.kcna.co.jp*.

127. Nick Wadhams, "Strong North Korea Resolution Will Help U.N. Security Council Confront Iran," The Associated Press, July 17, 2006, in Lexis-Nexis, *www.lexis-nexis.com*.

128. Joseph S. Bermudez, Jr., "North Korea Deploys New Missiles," *Jane's Defence Weekly*, August 4, 2004; David C. Isby, "North Korea Has Deployed Intermediate-range Ballistic Missiles," *Jane's Missiles and Rockets*, September 1, 2004; 조승진 [Cho Sung-jin], "北개발 미사일 함정 발사용?/잠수함 작아 탑재 어려워" ["Is the Missile Under Development by the North for Launching From Ships/Submarines too Small and too Difficult to Load?"], 서울신문 [*Seoul Sinmun*], August 5, 2004, in KINDS, *www.kinds.or.kr*; 최호원 [Ch'oe Ho-wŏn], "새로 배치된 北미사일 괌-하와이도 사정권에" ["Newly Deployed North Korean Missile Can Reach Guam and Hawaii"], 동아일보 [*Donga Ilbo*], July 8, 2004, in KINDS, *www.kinds.or.kr*.

129. In 2003 and early 2004, U.S. satellite imagery detected about 10 *Musudan* missiles and launchers at two underground missile bases under construction at Yangdŏk-kun, South P'yŏng'an Province, and Sangnam-ri, Hŏch'ŏn-kun, South Hamgyŏng Province. The construction of the bases was about 70-80 percent complete at that time. See James A. Foley, "Pyongyang Deploys New IRBMs," *Jane's Intelligence Review*, June 1, 2004; "North Korea May Be Resuming Its Ballistic-missile Programmes," *Jane's Missiles and Rockets*, July 1, 2004; 유용원 [Yu Yong-wŏn], "북, 4000km 신형미사일 쐈을 가능성 . . ." ["North Possibly Test-Fired

a New 4000km-Range Missile . . ."], 조선일보 [*Chosun Ilbo*], July 21, 2006, *www.chosun.com*.

130. "Northeast Asian Missile Forces: Defence and Offence," *Jane's Intelligence Review*, November 1, 2006.

131. In recent years only one or two Iranian transport aircraft have been visiting North Korea per year, but between April and mid-June 2003, six Iranian Il-76 transport planes visited Sunan International Airport near Pyongyang to pick up container cargo. Based on the dimensions of the containers, many analysts speculated that the containers held disassembled *Nodong* missiles; however, this could have been shipments of the so-called "BM-25" or *Musudan*. See Alon Ben-David, "Iran Acquires Ballistic Missiles from DPRK," *Jane's Defence Weekly*, January 4, 2006; "North Korea Exports Missiles to Iran by Air: Report," Agence France Presse, June 16, 2003, in Lexis-Nexis, *www.lexis-nexis.com*; "Iranian Aircraft Frequent Pyongyang," *The Korea Times*, June 17, 2003, in Lexis-Nexis, *www.lexis-nexis.com*.

132. Richard Spencer, "N Korea 'Tests New Missile in Iran'," *The Telegraph*, May 17, 2007, *www.telegraph.co.uk*; "S. Korea, U.S. Verifying Reports on Test of New N.K. Missile in Iran: Source," Yonhap News Agency, May 17, 2007, in Lexis-Nexis, *www.lexis-nexis.com*; 정승욱 [Chŏng Sŭng-uk], "北, 이란서 사거리 4000km 미사일 시험발사" ["North Test Launches 4000km-Range Missile in Iran"], 세계일보 [*Segye Ilbo*], May 16, 2007, *www.segye.com*.

133. Mark Fitzpatrick, "Iran and North Korea: The Proliferation Nexus," *Survival*, Vol. 48, No. 1, March 2006, pp. 61-80; Bill Gertz, "How the 'Axis' Seeks the Killer Missile; Pentagon Cites Pyongyang Test, Tehran's Search for ICBM to Hit U.S.," *The Washington Times*, January 30, 2007, in Lexis-Nexis, *www.lexis-nexis.com*; Greg Miller, "N. Korea Threat Lies in Nuclear Sales," *The Los Angeles Times*, October 21, 2006, in Lexis-Nexis, *www.lexis-nexis.com*; Paul Kerr, "Iran, North Korea Deepen Missile Cooperation," *Arms Control Today*, January/February 2007, *www.armscontrol.org/act/2007_01-02/IranNK.asp*; Nasser Karimi, "Iran Says It Wants Better Ties with North Korea, But Debts Are an Issue," The Associated Press, May 11, 2007, in Lexis-Nexis, *www.lexis-nexis.com*; "Iran's Foreign Minister Says North Korea's Debt Is Obstacle to Better Ties," Associated Press Financial Wire, May

11, 2007, in Lexis-Nexis, *www.lexis-nexis.com*; 김보은 [Kim Bo-ŭn], "北-이란 '무제한 협력'" ["North-Iran 'Unlimited Cooperation'"], 세계일보 [*Segye Ilbo*], Maye 12, 2007, *www.segye.com*.

134. Joseph S. Bermudez, Jr., "North Korea Deploys New Missiles," *Jane's Defence Weekly*, August 4, 2004; David C. Isby, "North Korea Has Deployed Intermediate-Range Ballistic Missiles," *Jane's Missiles and Rockets*, September 1, 2004; "Seoul Claims North Korea Is Developing IRBM," *Jane's Missiles and Rockets*, April 1, 2007; Joseph S. Bermudez, Jr., "Japan Reveals Name of North Korea's R-27 IRBM," *Jane's Missiles and Rockets*, July 1, 2007.

135. "Russian Scientists Accused of Wanting to Help North Korea Become a Nuclear Power," *Moscow News*, April 2, 1993, in Lexis-Nexis, *www.lexis-nexis.com*; 홍성균 [*Hong Sŏng-gyun*], "'높은 월급에 평양행 동경' /북행기도 러 과학자 폭로" ["'Yearning to Go to Pyongyang for High Salaries'/Russian Scientists' Plans to Go to the North Revealed"], 경향신문 [*Kyunghyang Sinmun*], April 2, 1993, in KINDS, *www.kinds.or.kr*.

136. *Ibid*.; David C. Isby, "North Korea Has Deployed Intermediate-Range Missiles," *Jane's Missiles and Rockets*, September 1, 2004.

137. Judith Perera and Andrei Ivanov, "Russia: Scientists Look to Europe after Korean Fiasco," IPS-Inter Press Service, April 16, 1993, in Lexis-Nexis, *www.lexis-nexis.com*; 장행훈 [*Chang Haeng-hun*], "북 취업기도 러 과학자 인터뷰/모스코뉴스 보도" ["Interview with Russian Scientist with Plan to Work in North/ Moscow News Report"], 동아일보 [*Donga Ilbo*], April 1, 1993, in KINDS, *www.kinds.or.kr*.

138. *Ibid*.; 홍성균 [Hong Sŏng-gyun], "'높은 월급에 평양행 동경' /북행기도 러 과학자 폭로" ["'Yearning to go to Pyongyang for high salaries'/Russian scientists' plans to go to the North revealed"].

139. In September 2003, *Musudan* missiles and mobile launchers reportedly were spotted at Mirim Airfield near Pyongyang in preparation for display during the September 9 parade in commemoration of the 55th anniversary of the founding of the DPRK. However, the missiles were not exhibited at the parade,

apparently for political considerations. See Daniel A. Pinkston, "North Korea Displays Ballistic Missiles during Military Parade, Some for First Time," *WMD Insights*, June 2007, *www.wmdinsights.com/I16/I16_EA1_NKDisplays.htm*.

140. *Ibid*. For background on the SS-21, see Steven Zaloga, "The *Tochka* Tactical Ballistic Missile System," *Jane's Intelligence Review*, Vol. 6, No. 1, January 1, 1994.

141. Jasper Becker, "Missile Deal for N Korea/Soviet Union to Supply SS-21s to Counter US Deployment in South Korea," *The Guardian*, London, England, January 29, 1987, in Lexis-Nexis, *www.lexis-nexis.com*.

142. Bermudez asserts the SS-21 transfers occurred "in the early 1990s, possibly 1994," while other analysts cite 1996. See Joseph S. Bermudez, Jr., "Proliferation in Pyongyang," *Jane's Defence Weekly*, June 1, 2005; Wyn Bowen and Stanley Shepard, "Living under the Red Missile Threat," *Jane's Intelligence Review*, Vol. 8, No. 12, December 1, 1996; "Ballistic Missiles, Syria," *Jane's Defence Weekly*, Vol. 31, No. 10, March 10, 1999; Duncan Lennox, "Co-operation Boosts Missile Proliferation," *Jane's Intelligence Review*, January 1, 2002; Robert Karniol, "North Korea Said to Have Tested Modified '*Scarab*' Missile," *Jane's Defence Weekly*, May 11, 2005.

143. According to Bermudez, the USSR provided somewhere between 27 and 63 *FROG-5*s in 1968, but refused to deliver additional *FROG-5*s or the *FROG-7*; however, Pyongyang was able to procure about 24-56 *FROG-7*s from Egypt in 1975 and 1976. Retired South Korean Lieutenant General and author Chang Chun-ik claims *FROG-5* and *FROG-7* rockets were delivered from 1968 to 1970. The South Korean monthly *Shindonga* has reported that North Korea received *FROG-3*, *FROG-5*, and *FROG-7* rockets from the USSR in 1969-1970. According to Kim P'il-su of South Korea's Agency for Defense Development, North Korea began to acquire *FROG-5*'s from the USSR in 1965. See Bermudez, "A History of Ballistic Missile Development . . .," pp. 4-5; 장준익 [Chang Jun-ik], 북한 핵-미사일 전쟁 [*North Korea Nuclear-Missile War*], Seoul, South Korea: Sŏmundang, 1999, pp. 246-247; 이정훈 [Yi Jŏng-hun], "프로그에서 대포동까지 북한의 미사일 게임" ["From the *FROG* to the *Taepodong*: North Korea's Missile Game"],

신동아 [*Shindonga*], August, 1999, p. 201; 김 필수 [Kim P'il-su], "북한의 탄도미사일 개발 현황" ["Current Status of North Korean Ballistic Missile Development"], *Defense Science and Technology Plus*, Vol. 38, 2007.07.01, *www.add.re.kr/plus/data/addplus_38.pdf*.

144. The equipment was procured by the pro-DPRK General Association of Korean Residents in Japan (Choch'ŏngnyŏn) and then shipped to North Korea. See "Firm Suspected of Illegal Sales to Iran also Tied to Pyongyang," *The Japan Times*, February 6, 2003, *search.japantimes.co.jp/cgi-bin/nn20030206a2.html*; "Japanese Firm Exported Missile-Related Equipment to N. Korea: Reports," Agence France Press, February 5, 2003, in Lexis-Nexis, *www.lexis-nexis.com*; "Seishin Jet Mill Sale Aided N. Korea; MPD Investigation Uncovers Export of Missile-Development Equipment in 1994," *The Daily Yomiuri*, June 13, 2003, in Lexis-Nexis, *www.lexis-nexis.com*.

145. Joseph S. Bermudez, Jr., "North Korea takes Wraps off *KN-02*," *Jane's Defence Weekly*, May 9, 2007; Joseph S. Bermudez, Jr., "Proliferation in Pyongyang," *Jane's Defence Weekly*, June 1, 2005; Duncan Lennox, "Short-Range Iranian Ballistic Missile on View," *Jane's Defence Weekly*, February 5, 2003.

146. Bermudez, "A History of Ballistic Missile Development . . .," pp. 19, 26, 32; Joseph S. Bermudez, Jr., "Proliferation in Pyongyang," *Jane's Defence Weekly*, June 1, 2005; Joseph S. Bermudez, Jr., "North Korea Takes Wraps off *KN-02*," *Jane's Defence Weekly*, May 9, 2007.

147. "北에 시리아 미사일 기술자 장기 연수, [Syrian Missile Technicians Receive Extended Training in the North]," 수선일보, [*Chosŏn Ilbo*], September 21, 2007, *nk.chosun.com*.

148. Pinkston, "North Korea Displays Ballistic Missiles . . .".

149. Bermudez, "North Korea Takes Wraps off *KN-02*"; 윤상호 [Yun Sang-ho], "北 신형 단거리 미사일 KN-O2의 실체" ["Essence of North's New Short-Range *KN-02* Missile"], 동아일보 [*Donga Ilbo*], July 18, 2007, in KINDS, *www.kinds.or.kr*.

150. The DPRK has 16 technical colleges, but Kim Il Sung University and Kim Chaek University of Technology are the

top engineering schools. 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], Seoul, South Korea: Ministry of Unification, 2003, p. 315.

151. 이춘근 [Yi Ch'un-gŭn], 북한의 과학기술 [*North Korea's Science and Technology*], Seoul, South Korea: Hanŭl, 2005, pp. 91-93.

152. *Ibid*.; "FBIS Analysis 14 Jul: Control Workstation has Potential Satellite Application," July 14, 2005, Open Source Center Document KPF20050714000198.

153. 이춘근 [Yi Ch'un-gŭn], 북한의 과학기술 [North Korea's Science and Technology], pp. 93-95.

154. 김재순 [Kim Chae-sun], "귀순 북한외교관 고영환씨 1문 1답" ["Questions and Answers with Defector and Former North Korean Diplomat Ko Yŏng-hwan"], 서울신문 [*Seoul Sinmun*], September 14, 1991, in KINDS, *www.kinds.or.kr*.

155. In November 2005, the Supreme People's Assembly issued a decree changing the name of the Academy of Sciences to the "State Academy of Sciences." "Academy of Sciences Renamed State Academy of Sciences in DPRK," Korean Central News Agency, November 25, 2005, *www.kcna.co.jp*.

156. For example, there are separate research institutes for semiconductors, physics, computer science, mathematics, metals, mechanical engineering, electronics, and artificial satellite information. 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], Seoul, South Korea: Ministry of Unification, 2003, p. 317.

157. Daniel A. Pinkston and Dave H. Kim, "DPRK Relying on Multiple Approaches to Acquire Foreign Technology," *WMD Insights*, March 2006, *www.wmdinsights.com/I3/EA3_DPRK_Relying.htm*.

158. 통일부 [Ministry of Unification], *2004* 북한개요 [*2004 North Korea Summary*], p. 320.

159. According to Kim Kil-sŏn, in 1997, the academy director was Chu Kyu-ch'ang, 주규창). See이정훈 [Yi Jŏng-hun], "북한 미사일 실제 이름은 '화성'" ["The Real Name of North Korean Missiles is '*Hwasŏng*'"], 주간동아 [*Chugan Donga*], Issue 212, December 9, 1999, *www.donga.com/docs/magazine/weekly_donga/news212/wd212cc020.html*.

160. 김민세 [Kim Min-se], "北 미사일개발 본산은 제2 자연과학원 함흥분원" ["North's Missile Development Done at the Second Natural Science Academy's Hamhŭng Branch"]. The Academy of Sciences was changed to the "State Academy of Sciences" by the Supreme People's Assembly on November 23, 2005. "과학원을 국가과학원으로 함에 대한 정령" ["Cabinet Order to Change the Name of the Academy of Sciences to the State Academy of Sciences"], 조선중앙통신 [Korean Central News Agency], November 23, 2005, *www.kcna.co.jp*; "Academy of Sciences Renamed State Academy of Sciences in DPRK," Korean Central News Agency, November 25, 2005, *www.kcna.co.jp*.

161. The State Academy of Sciences institutes are located in Ch'ŏngsong-dong, Hŭisang-guyŏk, and in Chŏngsŏng-dong, Hŭisang-guyŏk, but Yi Chŏng-yŏn claims the missile research facility is in Hŭiyang-dong, Hŭisang-guyŏk. See김민세 [Kim Min-se], "北 미사일개발 본산은 제2자연과학원 함흥분원" ["North's Missile Development Done at the Second Natural Science Academy's Hamhŭng Branch"], *The Daily NK*, February 23, 2007, *www.dailynk.com*; 이춘근 [Yi Ch'un-gŭn], 북한의 과학기술 [North Korea's Science and Technology], pp. 81, 335.

162. 김민세 [Kim Min-se], "北 미사일개발 본산은 제2 자연과학원 함흥분원" ["North's Missile Development Done at the Second Natural Science Academy's Hamhŭng Branch"], *The Daily NK*, February 23, 2007, *www.dailynk.com*.

163. 이춘근 [Yi Ch'un-gŭn], 북한의 과학기술 [North Korea's Science and Technology], pp. 81, 335.

164. Barbara Starr, "N. Korea Casts a Longer Shadow with TD-2," *Jane's Defence Weekly*, March 12, 1994, p. 1; Bermudez, "A History of Ballistic Missile Development . . .," pp. 10, 23, 28; 김영철 [Kim Yŏng-ch'ŏl], "85년 스커드B 성공뒤 사정거리 늘려/북 미사일 개발 현황" ["Increasing the Range after Succeeding with the *Scud-B* in 1985/Current Status of the North's

Missile Development"], 한겨레 [*Hankryoreh*] September 1, 1998, in KINDS, *www.kinds.or.kr*; 박성진 [Park Sŏng-jin], "說 . . . 說 . . . 끊는 '대포동' 진실은 뭘까" ["All the Talk about the *'Taepodong'*, What Is It Really?"], 경향신문 [*Kyunghyang Sinmun*], June 21, 2006, in KINDS, *www.kinds.or.kr*; 박재범 [Park Chae-bŏm], "북, 사정 1만㎞ 미사일 개발/「대포동2호」정보 러시아서 입수" ["North Developing 10,000km-Range Missile/(*Taepodong-2)*, Information Acquired from Russia"], 서울신문 [*Seoul Sinmun*], September 11, 1995, in KINDS, *www.kinds.or.kr*; 차세현 [Ch'a Se-hyŏn], "'日 본토 전역이 사정권' 현실로/北 '대포동1호' 군사적 위협" ["Ability to Strike All of Japan Realized/Military Threat of North's *Taepodong-1*"], 경향신문 [*Kyunghyang Sinmun*], September 1, 1998, in KINDS, *www.kinds.or.kr*.

165. Kangsŏ-kun originally was part of South P'yŏng'an Province, but was incorporated into the City of Taean in March 1978. In January 2004, it was reestablished as a "kun" [county] in South P'yŏng'an Province. A missile facility in Chamjin-ri, 箴進里, Kangsŏ-kun was identified as the assembly site for the *Paektusan-2* that was flight tested in July 2006, and Chamjin-ri is in the same general area with Sanŏp-dong that borders Ch'ŏllima-kun and Pyongyang. *JoongAng Ilbo,* North Korea geographic database, "북한네트: 지리" ["North Korea Net: Geography"], 중앙일보 [*JoongAng Ilbo*], *nk.joins.com/map*.

166. "'Pyongyang Pig Factory' Produces Missiles," *Chosun Ilbo*, February 12, 2001, *english.chosun.com/w21data/html/news/200102/200102120194.html*.

167. In January 2008, it was revealed that former chairman Kim Ch'ŏl-man has been replaced by Paek Se-bong, probably in 2003. See "北 군수전담 제2경제위원장은 백세봉 국방위원 [NDC Member Paek Se-bong Is Chairman of the Second Economic Committee, in Charge of All the North's Munitions], 중앙일보 [*Joongang Ilbo*], January 14, 2008, *article.joins.com/article/article.asp?ctg=&total_id=3009819*.

168. 임강택 [Im Kang-t'aek], "북한의 군수산업 정책" [North Korea's Arms Industry and Policy"], 북한연구학회 편집 [Association of North Korean Studies Scholars, ed.], 북한의 군사 [North Korean Military Affairs], Seoul, South Korea: Kyŏng'inmunhwasa, 2006, pp. 441-442.

169. *Ibid*., pp. 68-72; 442-449.

170. 송승호 [Song Sŭng-ho], "北韓 최고인민회의 대의원 韓國에 망명, 核개발에 대한 중대 증언" ["North Korean Supreme People's Assembly Member Defects to South Korea, Gives Grave Testimony about Nuclear Developments"], 月刊朝鮮 [*Wŏlgan Chosun*], August 2005, *monthly.chosun.com*; "北최고인민회의 대의원 韓國망명" ["Supreme People's Assembly Member Defects to South Korea"], 조선일보 [*Chosun Ilbo*], July 17, 2005, *nk.chosun.com*.

171. *Ibid*.

172. "Spokesman for DPRK FM Dismisses Sheer Lie Spread by Some Unsavory Forces," Korean central News Agency, July 19, 2005, *www.kcna.co.jp*; "조선외무성대변인 대의원《망명》설은 완전한 날조" ["Korean Foreign Ministry Spokesman Says Talk of a Supreme People's Assembly Member's (Defection) Is a Complete Fabrication"], 조선중앙통신 [Korean Central News Agency], July 19, 2005, *www.kcna.co.jp*.

173. "북한/ '노동당 제2경제위 무기수출 수십억달러 독점'" ["North Korea/Second Economic Committee Has a Several Billion Dollar Monopoly for the Export of Weapons"], 한국일보 [*Hankook Ilbo*], February 21, 1999, in KINDS, *www.kinds.or.kr*.

174. U.S. Department of State, Bureau of International Security and Nonproliferation, "Missile Sanctions Laws," *www.state.gov/t/isn/c15232.htm*; "Chronology of U.S.-North Korean Nuclear and Missile Diplomacy," *Arms Control Today*, June 2003, *www.armscontrol.org/factsheets/dprkchron.asp*; Wisconsin Project on Nuclear Arms Control, "North Korean Missile Exports," *The Risk Report*, Vol. 2, No. 6, November-December 1996, *www.wisconsinproject.org/countries/nkorea/north-korea-missile-exports.html*; Wisconsin Project on Nuclear Arms Control, "North Korea Missile Update–2005," *The Risk Report*, Vol. 11, No. 6, November-December 2005, *www.wisconsinproject.org/countries/nkorea/missileupdate2005.html*.

175. *Ibid*.; Daniel A. Pinkston, "Domestic Politics and Stakeholders in the North Korean Missile Development Program," *The Nonproliferation Review*, Summer 2003, *cns.miis.edu/pubs/npr/vol10/102/102pink.pdf*; Donald Greenlees, "Macao Inquiry Clears Bank of Money Laundering for N. Korea," *International Herald Tribune*, March 12, 2007, *www.iht.com/articles/2007/03/12/news/bank.php*; 이상일 [Yi Sang-il], "북 미사일 개발 돈줄 단천은행 BDA와 거래했다" ["BDA Had Transactions with Tanch'ŏn Bank, Which Provides Funds for the North's Missile Development"], 중앙일보 [*JoongAng Ilbo*], March 16, 2007, *news.joins.com/nknet/200703/16/200703160445511731m000m260m261.html*.

176. The missiles, fuel, and oxidizer were concealed beneath bags of cement, and the vessel was reportedly stopped for not flying a national flag. Matt Kelley, "Ship Carrying Dozen North Korean Missiles Intercepted in Arabian Sea," Associated Press, December 11, 2002, in Lexis-Nexis, *www.lexis-nexis.com*; "15 *Scud* Missiles Found on Ship from N. Korea," Japan Economic Newswire, December 11, 2002, in Lexis-Nexis, *www.lexis-nexis.com*; 박완규 [Park Wan-kyu], "北미사일 수송선 나포/수출현장 첫 적발 파문-전망/北 대량살상무기 확산국 입증" ["Ship Transporting North's Missiles Seized/First Disclosure Of Export Recipient to Cause a Stir--View/Proof the North Is a WMD Proliferating Country"], 세계일보 [*Segye Ilbo*], December 12, 2002, in KINDS, *www.kinds.or.kr*.

177. "US to Release Ship with Missiles for Yemen," Xinhua News Agency, December 11, 2002, in Lexis-Nexis, *www.lexis-nexis.com*.

178. Daniel A. Pinkston, "Domestic Politics and Stakeholders in the North Korean Missile Development Program," *The Nonproliferation Review*, Summer 2003, *cns.miis.edu/pubs/npr/vol10/102/102pink.pdf*.

179. For an example of North Korea's extensive underground tunnels, see Barbara Demick, "N. Korea's Ace in the Hole," *The Los Angeles Times*, November 14, 2003, p. A1.

180. "Prepared Statement of Ju-hwal Choi, Former Official, Ministry of the People's Army, North Korea, North Korean Missile Proliferation Hearing before the Subcommittee on International

Security, Proliferation, and Federal Services of the Committee on Governmental Affairs, United States Senate," October 21, 1997, *www.globalsecurity.org/wmd/library/congress/1997_h/s971021choi.htm*; interview with Ch'oe Ju Hwal by Daniel A. Pinkston, April 9, 2001, Seoul, South Korea; "'Pyongyang Pig Factory' Produces Missiles," *Chosun Ilbo*, February 12, 2001, *english.chosun.com/w21data/html/news/200102/200102120194.html*; 김광인 [Kim Kwang-in], "'평양돼지공장'에서 미사일 생산" ["Missiles Produced at Pyongyang 'Pig Factory'"], 조선일보 [*Chosun Ilbo*], February 11, 2001, *nk.chosun.com.*

181. Interview with Kim Kil Sŏn by Daniel A. Pinkston, April 10, 2001, Seoul, South Korea; 이정훈 [Yi Jŏng-hun], "북한 미사일 실제 이름은 '화성'" ["The Real Name of North Korean Missiles Is '*Hwasŏng*'"], 주간동아 [*Chugan Donga*], Issue 212, December 9, 1999, *www.donga.com/docs/magazine/weekly_donga/news212/wd212cc020.html*; 김인철 [Kim In-chŏl], "전 김일성 통역관겸 고위외교관/고영환은 말한다: 6" ["Former Interpreter for Kim Il-Sŏng and High-Level Diplomat/Ko Yŏng-Hwan Speaks: 6"], 서울신문 [*Seoul Sinmun*], October 9, 1991, in KINDS, *www.kinds.or.kr*.

182. 양정아 [Yang Chŏng-a], "대포동 2호 北 잠진 군수공장서 제조" ["*Taepodong-2* Manufactured at Chamjin Munitions Factory Near Namp'o"], *The Daily NK*, June 20, 2006, *www.dailynk.com/korean/read.php?cataId=nk00100&num=23865*; 이영종 [Yi Yŏng-jong], "남포서 만든 대포동 2호 위장막 씌워 발사장 이동" ["*Taepodong-2* Made In Namp'o and Transported to Launch Site with Camouflage Cover"], 중앙일보 [*JoongAng Ilbo*], June 20, 2006, *www.joins.com*; 정충신 [Chŏng Ch'ung-sin], "뉴스기획/北미사일 발사 임박-美•日 군사적 대응 태세" ["News Plan/North's Missile Launch Imminent--U.S. Japan Prepare Military Response"], 문화일보 [*Munhwa Ilbo*], June 20, 2006, in KINDS, *www.kinds.or.kr*; 정충신 [Chŏng Ch'ung-sin], "北 대포동2호 미사일1기 어디로 갔나" [Where Did One of the North's *Taepodong-2* Missiles Go?"], 문화일보 [*Munhwa Ilbo*], August 4, 2006, in KINDS, *www.kinds.or.kr*.

183. 조호연 [Cho Ho-yŏn], "北에 미사일공장 4곳이상 있다" ["There Are At Least 4 Missile Factories in the North"], 경향신문 [*Kyunghyang Sinmun*], March 26, 1999, in KINDS, *www.kinds.or.kr*. In January 2004, Kangsŏ-kuyŏk in the City of Taean was changed

into a "kun", or county, and placed under the administrative jurisdiction of South P'yŏng'an Province. North Korea Geographic Database, "북한네트: 지리" ["North Korea Net: Geography"], 중앙일보 [*JoongAng Ilbo*], *nk.joins.com/map*.

184. North Korean "industrial complexes" (聯合企業所) are said to be compartmentalized so that workers cannot enter other factories or production facilities. Conceivably, the missile production plant could also be compartmentalized with different names for different parts of the plant, or names for the plant could have changed over time.

185. The missiles were probably deployed to this area for additional testing. 장준익 [Chang Jun-ik], 북한 핵-미사일 전쟁 [*North Korea Nuclear-Missile War*], Seoul, South Korea: Sŏmundang, 1999, p. 270.

186. *Ibid*.

187. Yonhap News Agency, "North Said to Possess 1,000 Tons of Warheads," FBIS-EAS-91-135, July 15, 1991, p. 23; "한보특혜」 수사 용의는/국회상위/북한 스커드부대 증편" ["Hanbo Special Favors Investigation Suspicions/National Assembly Disagreements/North Korea Expands *Scud* Unit"], 한국일보 [*Hankook Ilbo*], July 17, 1991, in KINDS, *www.kinds.or.kr*; "North Reportedly Expands *Scud* Unit," FBIS-EAS-91-16526, *Donga Ilbo*, August 25, 1991, pp. 32-33; "북한 「스커드 미사일여단」 창설/국방부 위성자료분석 밝혀" ["North Korea Establishes '*Scud* Missile Brigade'/Defense Ministry Discloses Satellite Imagery Analysis"], 동아일보 [*Donga Ilbo*], August 25, 1991, in KINDS, *www.kinds.or.kr*.

188. Bermudez asserts that the *Hwasŏng* regiment was expanded by 1991 but was not reorganized into a brigade. Bermudez, "A History of Ballistic Missile Development . . .," pp. 11, 17.

189. North Korea also has built fake facilities and deployed decoy vehicles and missiles. See Joseph S. Bermudez, Jr., *The Armed Forces of North Korea*, New York: I. B. Taurus, 2001, p. 279.

190. Testimony of Ko Yŏng-hwan, former North Korean Foreign Ministry official, before the United States Senate, October

21, 1997; interview with North Korean defector Im Yŏng-sŏn by Daniel A. Pinkston, December 14, 2001, Seoul, South Korea.

191. B. B. Bell, "Statement of General B. B. Bell, Commander, United Nations Command; Commander, Republic of Korea-United States Combined Forces Command; and Commander, United States Forces Korea before the House Armed Services Committee," March 9, 2006; B. B. Bell, "Statement of General B. B. Bell, Commander, United Nations Command; Commander, Republic of Korea-United States Combined Forces Command; and Commander, United States Forces Korea before the Senate Armed Services Committee," April 24, 2007. Some of the DPRK's *Hwasŏng* missiles could be extended-range Scud variants (Scud-D and/or Scud-ER) capable of striking Japan, but the number of these systems in the DPRK inventory is unknown.

192. For details on the sequence of preparations for a *Scud* missile launch, see Steven J. Zaloga, *Scud Ballsitic Missile and Launch Systems 1955-2005*, Oxford, England: Osprey Publishing, 2006, pp. 21-23. The Soviets reportedly required about 90 minutes to prepare a missile for launch, but the Iraqi military reduced the time to less than 30 minutes after their experience in the "War of the Cities" with Iran. Tim Ripley, "*Scud* Hunting: Counter-force Operations against Theatre Ballistic Missiles," Bailrigg Memorandum 18, Lancaster, England: Centre for Defence and International Security Studies, Lancaster University, 1996, *www.cdiss.org/documents/uploaded/Scud%20Hunting%20-%20BM%2018.pdf*.

193. Despite a dedicated effort to suppress Iraqi *Scud*s during the Gulf War in 1991, coalition forces had extreme difficulties and were mostly unsuccessful. For an overview and analysis of recent discussions in Japan regarding a preemptive strike against DPRK missiles, see Daniel A. Pinkston and Kazutaka Sakurai, "Japan Debates Preparing for Future Preemptive Strikes against North Korea," *The Korean Journal of Defense Analysis*, Vol. 18, No. 4, Winter 2006, pp. 95-121.

194. Joseph S. Bermudez, Jr., "Moving Missiles," *Jane's Defence Weekly*, August 3, 2005; Joseph S. Bermudez, Jr., *The Armed Forces of North Korea*, New York: I. B. Taurus, 2001, pp. 267-268; 김귀근 [Kim Kwi-gŭn], "<北, 야포-미사일전력 위주 군사력 증강>

[<Artillery and Missiles Are the North's First Consideration When Increasing Its Military Power >]," Yonhap News Agency, February 4, 2005, *www.yonhapnews.net*.

195. Joseph S. Bermudez, Jr., "North Korea's Chemical and Biological Warfare Arsenal," *Jane's Intelligence Review*, Vol. 5, No. 5, May 1, 1993; Dennis Gormley, "Prevent a Ballistic Missile Fire Sale," *Defense News*, February 17, 1992, pp. 31-32.

196. CIA, "Attachment A: Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July Through 31 December 2003," *www.cia.gov/cia/reports/721_reports/july_dec2003.htm#5*.

197. Eric Croddy with Clarisa Perez-Armendariz and John Hart, *Chemical and Biological Warfare*, New York: Copernicus Books, 2002, p. 52.

198. "US Praises Taiwan for Seizure of Chemicals aboard North Korean Freighter," Central News Agency, Taipei, August 13, 2003, BBC Worldwide Monitoring, in Lexis-Nexis, *www.lexis-nexis.com*; Jay Chen and Deborah Kuo, "U.S. Lauds Taiwan for Seizure of Chemicals aboard N. Korean Freighter," Central News Agency, Taiwan, August 13, 2003, in Lexis-Nexis, *www.lexis-nexis.com*; "Report: Gas Chemical Shipped to N. Korea," United Press International, February 18, 2003, in Lexis-Nexis, *www.lexis-nexis.com*; Tom Kelly, "'*Scud* Ship 'Delivered Nerve Gas Agent to North Korea," Press Association, February 18, 2003, in Lexis-Nexis, *www.lexis-nexis.com*; "U.S. Intercepts Two deliveries of Nuclear Material for North Korea," *The Korea Herald*, June 2, 2005, in Lexis-Nexis, *www.lexis-nexis.com*; "US Has Intercepted N Korea-Bound Nuclear, Chemical Materials--Spokesman," Yonhap News Agency, BBC Worldwide Monitoring, June 1, 2005, in Lexis-Nexis, *www.lexis-nexis.com*.

199. "Six South Korean Firms Punished for Illegal Chemical Exports," *International Export Control Observer*, Issue 8, June 2006, p. 15, *cns.miis.edu/pubs/observer/pdfs/ieco_0606e.pdf*; "S[outh]Korea Businessman Exported Toxic Chemical to N[orth]Korea via China--Skorea Govt," Xinhua Financial Network News, September 24, 2004, in Lexis-Nexis, *www.lexis-nexis.com*; "NK's Chemical Imports

Raise Alarm," *Korea Times*, September 25, 2004, in Lexis-Nexis, *www.lexis-nexis.com*; "South Korea Exporting Large Quantities of Sodium Cyanide Since 2000," Yonhap News Agency, October 7, 2004, BBC Worldwide Monitoring, October 7, 2004, in Lexis-Nexis, *www.lexis-nexis.com*.

200. CIA, "Attachment A: Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July Through 31 December 2003," *www.cia.gov/cia/reports/721_reports/july_dec2003.htm#5*.

201. "North Korea: WMD Proliferation," *Jane's Intelligence Digest*, December 19, 2003.

202. B. B. Bell, "Statement … before the House Armed Services Committee," March 9, 2006.

203. 장준익 [Chang Jun-ik], 북한 핵-미사일 전쟁 [*North Korea Nuclear-Missile War*], Seoul, South Korea: Sŏmundang, 1999, pp. 366-367; 신혜식 [Sin Hye-sik], "북 생-화학무기시설 49 곳, '위협될수'" ["North's 49 Facilities for Biological and Chemical Weapons Can Be a Threat"], Break News, October 17, 2006, in KINDS, *www.kinds.or.kr*; "김태환 의원 '북한 생화학무기시설 49 곳'" ["National Assemblyman Kim T'ae-hwan: 'North Korea Has 49 Facilities for Biological and Chemical Weapons'"], 조선일보 [*Chosun Ilbo*], October 17, 2006, *www.chosun.com*; 이천열 [Yi Ch'ŏn-yŏl], "북 생화학무기시설 49 곳" ["North Has 49 Facilities for Biological and Chemical Weapons"], 서울신문 [*Seoul Sinmun*], October 18, 2006, in KINDS, *www.kinds.or.kr*; 김요셉 [Kim Yo-sep], "국감 2006 북한 화학무기시설 49 곳 실태공개" ["2006 National Assembly Hearings, North Korea's 49 Chemical Weapons Facilities Revealed"], 대덕넷 [*Taedŏk Net*], October 17, 2006, *www.hellodd.com*.

204. 신성택 [Sin Sŏng-t'aek], "북한의 화학무기 위협 및 대응방안" ["North Korean Chemical Weapons Threat and Proposed Countermeasures"], Chapter 3, in 북한의대량살상무기별 위협분석 및 대응책연구 [*Threat Analysis of North Korea's Weapons of Mass Destruction and Research on Countermeasures*], Seoul, South Korea: Korea Institute of Defense Analysis, 국방정책연구보고서 번호 00-052 [National Defense Policy Research Report Number 00-052], December 2000; 장준익 [Chang Jun-ik], 북한 핵-미사일

전쟁 [*North Korea Nuclear-Missile War*], pp. 369-375; 장명순 [Chang Myŏng-sun], 북한군사연구 [*North Korean Military Affairs Research*], Seoul, South Korea: P'albog'wŏnch'ulp'ansa, 1999, p. 293.

205. CW delivered by artillery certainly would be devastating to the Seoul and Inch'ŏn metropolitan areas near the DMZ.

206. "북한행 러 과학자/핵탄제조 전문가/러 일간지 보도" ["Russian Daily Reports that Russian Scientists and Specialists in Nuclear Warheads Headed to the North"], 한국일보 [*Hankook Ilbo*], February 9, 1993, p. 2, in KINDS, *www.kinds.or.kr*.

207. Barbara Starr, "No Dongs May Be Nuclear, Warns USN," *Jane's Defence Weekly*, Vol. 21, No. 24, June 18, 1994.

208. David E. Sanger, "Pakistani Says He Saw North Korean Nuclear Devices," *The New York Times*, April 13, 2004, *www.nytimes.com*; James A. Foley, "Khan Shown North Korean Nuclear Weapons," *Jane's Intelligence Review*, May 1, 2004.

209. "Statement of DPRK Government on Its Withdrawal from NPT," Korean Central News Agency, January 10, 2003, *www.kcna.co.jp*; "DPRK FM on Its Stand to Suspend Its Participation in Six-Party Talks for Indefinite Period," Korean Central News Agency, February 10, 2005, *www.kcna.co.jp*; James Brooke and David E. Sanger, "North Koreans Say They Hold Nuclear Arms," *The New York Times*, February 11, 2005, *www.nytimes.com*.

210. Lowell E. Jacoby, "Current and Projected National Security Threats to the United States," Statement For the Record, before the Senate Select Committee on Intelligence, February 24, 2004.

211. David S. Cloud and David E. Sanger, "U.S. Aide Sees Nuclear Arms Advance by North Korea," *The New York Times*, April 29, 2005, *www.nytimes.com*; "US Makes North Korean Warheads Claim," *Jane's Missiles and Rockets*, June 1, 2005.

212. DPRK Foreign Ministry Clarifies Stand on New Measure to Bolster War Deterrent," Korean Central News Agency, October 3, 2006, *www.kcna.co.jp*; "DPRK Successfully Conducts

Underground Nuclear Test," Korean Central News Agency, October 9, 2006, *www.kcna.co.jp*.

213. Siegfried S. Hecker, "Report on North Korean Nuclear Program," Palo Alto, CA: Center for International Security and Cooperation, Stanford University, November 15, 2006.

214. Mark Hibbs, "DPRK Test Shot Highly Inefficient, May Be Design Flaw, Experts Say," *Nucleonics Week*, Vol. 47, No. 41, October 12, 2006.

215. 송승호 [Song Sŭng-ho], "北韓 최고인민회의 대의원 韓國에 망명, 核개발에 대한 중대 증언" ["North Korean Supreme People's Assembly Member Defects to South Korea, Gives Grave Testimony About Nuclear Developments"], 月刊朝鮮 [*Wŏlgan Chosun*], August 2005, *monthly.chosun.com*.

216. 고재홍 [Ko Jae-hong], "북한군 최고사령관의 군사지휘체계" ["North Korean Military Supreme Command and Military Command System"], 북한연구학회 편집 [Association of North Korean Studies Scholars, ed.], 북한의 군사 [*North Korean Military Affairs*], Seoul, South Korea: Kyŏng'inmunhwasa, 2006, p. 214.

217. 통일부 [Ministry of Unification], *2004*, 북한개요 [*2004 North Korea Summary*], pp. 104-105.

218. "'북전시사업세칙' 입수/세부내용 어떻게--개전 24 시간내 당.군.민 총동원" ["North's Wartime Operations Rules Acquired/Detailed Contents Tell How All of the Party, Military, and People Will Be Mobilized Within 24 Hours of a War Breaking Out"], 경향신문 [*Kyunghyang Sinmun*], January 5, 2005, in KINDS, *www.kinds.or.kr*; Jong-heon Lee, "Analysis: N. Korea's War Contingency Plan," UPI, January 5, 2005, in Lexis-Nexis, *www. lexis-nexis.com*.